



Annex D - Final Design Report



Yatta Water Supply Project (YWSP)

Phase 1- LRPS-2021-9164656

Final DESIGN REPORT

OFFICE

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Terms of Reference – Final Design Report

7.4 Final Design and set of Tender documents

Final design and tender documents to be submitted to UNICEF, following the approval of the preliminary design report, for review and comments.

The report shall include the final design; along with description of the analyzed alternatives at all levels (design approaches, materials, equipment, ...etc.), all required drawings, itemized Bill of Quantities and Engineering Estimate, with detailed and thorough item descriptions that are formulated to safeguard UNICEF interests and mitigating the risks of variation orders and “avoidable” claims during the construction stage, reasonable and updated cost estimates against the detailed BoQs; along with detailed & priced list of all required materials and equipment, and the schedule of delivery and complete tender documents, updated and comprehensive technical specifications and required annexes /clarifications

Stage 2	
1	Draft Final Design Report and drawings and draft tender documents
2	Final Design Report and drawings and Final tender documents
3	Final ESIA Report
4	Confidential engineers estimate



Kingdom of the Netherlands

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Table of Contents

1. Introduction	7
1.1 BACKGROUND	7
1.2 PURPOSE OF THE DESIGN REPORT	8
1.3 OBJECTIVES OF THE DESIGN REPORT	8
1.4 LIST OF TASKS UNDER ACTIVITY 6: FINAL DESIGN REPORT	9
2. General Scope of Works	10
3. HYDRAULIC Study	11
3.1 HYDRAULIC DESIGN CRITERIA	11
3.1.1 INDUSTRIAL CONSUMPTION	11
3.1.2 HOURLY DEMAND PATTERN	11
3.1.3 SEASONAL PEAK FLOW	12
3.1.4 NETWORKS LOSSES	12
3.1.5 PUMPING STATIONS & BOOSTER STATIONS	13
3.1.6 MAX. VELOCITY	13
3.1.7 PRESSURE	13
3.2 PIPE DESIGN CRITERIA	13
3.3 POPULATION PROJECTION AND DEMAND	14
4. Detailed Design	17
4.1 MAIN TRANSMISSION PIPELINES	17
4.2 DISTRIBUTION NETWORK	20
4.3 EXTENSION AREA- ADDITIONAL PIPE WORKS	22
4.4 ASPHALT REINSTATMENT WORKS	24
4.5 CLEANING, WASHING, HYDRAULIC TEST PRESSURE TESTING	24
4.6 VALVE CHAMBERS	26
4.6.1 ISOLATION VALVES	26
4.6.2 PRVS	26
4.6.3 AIR VALVES	28
4.6.4 WASH OUT	28
4.7 COMPLEMENTARY WORKS: BEIT AMMRA 500M ³ ELEVATED TANK	28
4.8 COMPLEMENTARY WORKS: SCHOOL TANK 1000M ³ RESERVOIR	29
4.9 COMPLEMENTARY WORKS: KHALET SALEM 5000M ³ RESERVOIR	29
4.10 COMPLEMENTARY WORKS: EQUIPPING EXISTING CHAMBERS	30
5. CONTROL VALVES AND SCADA	36
5.1 FLOWMETERS- CONNECTION CHAMBERS	36

5.2	FLOWMETERS- AT RESERVOIR	37
5.3	RESERVOIRS LEVEL SENSOR	38
5.4	SCADA PHILOSOPHY	38
5.4.1	DESCRIPTION OF WORKS	38
5.4.2	SCOPE OF WORKS	38
5.4.3	DESCRIPTION OF YATTA SCADA SYSTEM	39
5.4.4	DESCRIPTION OF WBWD SCADA SYSTEM	40
5.4.5	WORKS INCLUDED FOR THE TWO SCADA CONTROL CENTERS	42
5.4.6	STANDARDS	45
5.5	SCADA MONITORING ROOM	45
6.	CAPACITY BUILDING COMPONENTS	46
6.1	TRANSFER OF ASSETS	46
6.2	INSTITUTIONAL AND CAPACITY BUILDING	46
6.3	PROCUREMENT OF EQUIPMENT	47
6.4	TRAINING OF YM STAFF	48
7	PRELIMINARY COST ESTIMATE AND WORKS PACKAGES	49
7.1	PRELIMINARY COST ESTIMATE	49
7.1.1	CONSTRUCTION COSTS	49
7.1.2	SUPERVISION COSTS	50
7.1.3	TRAINING PROGRAMME COSTS	50
7.1.4	TRANSFER OF ASSETS COSTS	50
7.1.5	CAPACITY BUILDING AND INSTITUTIONAL SETUP COSTS	51
7.1.6	SUPPLY OF EQUIPMENT COST	51
7.1.7	SUMMARY OF TOTAL COSTS	52
7.2	TENDERING DOCUMENTS	53
8.	PROJECT IMPLEMENTATION/ Action PLAN	55
9.	DISBURSEMENT Plan/ FORECAST	57
Appendices 59		
APPENDIX 1: LISTS OF MATERIALS AVAILABLE FOR THE PROJECT		60
APPENDIX 2: TENDER DOCUMENTS		61

List of Tables

TABLE 1. LIST OF ACTIVITIES UNDER ACTIVITY 5,6 AND 8: FINAL DESIGN REPORT	9
TABLE 2. INDUSTRIAL CONSUMPTION PERCENTAGE ACCORDING TO PWA	11
TABLE 3. DESIGN CRITERIA- NETWORK LOSSES	13
TABLE 4. POPULATION PROJECTIONS FOR 2025 AND 2040 FOR THE SEVEN COMMUNITIES UNDER CONSIDERATION	14
TABLE 5. WATER SUPPLY AND PROJECT DEMAND FORECAST	15
TABLE 6. MAIN TRANSMISSION LINES (INSTALLED IN 2019 PROJECT)	17
TABLE 7. ADDITIONAL WORKS -MAIN TRANSMISSION LINES	18
TABLE 8. DISTRIBUTION PIPE LINES	20
TABLE 9. SUPPLEMENTARY WORKS –DISTRIBUTION PIPE LINES	20
TABLE 9A. SUPPLEMENTARY WORKS –DISTRIBUTION PIPE LINES	22
TABLE 10. ISOLATION VALVE IN CHAMBER	26
TABLE 11. PRESSURE REDUCING VALVE	26
TABLE 12. AIR RELEASE VALVE	28
TABLE 13. WASH OUT VALVE	28
TABLE 14. BEIT AMMRA ELEVATED TANK- PRELIMINARY DESIGNED ACTIVATES	29
TABLE 15. SCHOOL TANK- PRELIMINARY DESIGNED ACTIVATES	29
TABLE 16. KHAKET SALEM- PRELIMINARY DESIGNED ACTIVATES	30
TABLE 17. MAIN MONITORING (CONNECTION) VALVE	37
TABLE 18. MAIN MONITORING (CONNECTION) VALVE	37
TABLE 19. RECOMMENDED EQUIPMENT	47
TABLE 20. RECOMMENDED TRAINING TOPICS	48
TABLE 21. CONSTRUCTION WORKS COMPONENTS AND PRICES	49
TABLE 22. SUPERVISION COSTS AND MIN. STAFF REQUIREMENTS	50
TABLE 23. RECOMMENDED TRAINING TOPICS	50
TABLE 24. PROCUREMENT OF EQUIPMENT COSTS	51
TABLE 25. TOTAL ESTIMATED COST FOR YWSP	52
TABLE 26. TENDER DOCUMENTS TYPES	53
TABLE 27. PROPOSED PROCUREMENT PLAN	54
TABLE 28. YWSP IMPLEMENTATION PLAN	56
TABLE 29. DISBURSEMENT CASH FLOW FORECAST FOR YWSP	58

List of Figures

FIGURE 1: HOURLY DEMAND PATTERN USED FOR CHECKING THE HYDRAULIC MODELLING	12
FIGURE 2: YATTA WATER SUPPLY SYSTEM- PROCESS DIAGRAM	16
FIGURE 3: MAIN TRANSMISSION LINE INSTALLED IN 2019 (PART 1)	17
FIGURE 4: MAIN TRANSMISSION LINE INSTALLED IN 2019 (PART 2)	18
FIGURE 5: GENERAL LAYOUT FOR MAIN TRANSMISSION LINE	19
FIGURE 6: GENERAL LAYOUT FOR THE DISTRIBUTION NETWORK	21
FIGURE 7. THE REINSTATEMENT WORKS DONE BY YATA MUNICIPALITY AND OTHER PARTIES	25
FIGURE 8: PRESSURE REDUCING VALVE LOCATIONS	27
FIGURE 9. CAST IN SITU CHAMBER- REMINING WORKS FOR EACH CHAMBER	31
FIGURE 10. PRECAST MANHOLES/CHAMBERS- REMINING WORKS FOR EACH CHAMBER (PART 1)	32
FIGURE 11. PRECAST MANHOLES/CHAMBERS- REMINING WORKS FOR EACH CHAMBER (PART 2)	33
FIGURE 12. PRECAST MANHOLES/CHAMBERS- REMINING WORKS FOR EACH CHAMBER (PART 3)	34
FIGURE 13. PRECAST MANHOLES/CHAMBERS- REMINING WORKS FOR EACH CHAMBER (PART 4)	35
FIGURE 14. YATA SCADA SYSTEM- MAIN CONNECTIONS	36
FIGURE 15. YATA SCADA SYSTEM- MAIN RESERVOIRS	37
FIGURE 17. PROJECT IMPLEMENTATION PLAN FOR WORKS	55

Abbreviations

BoQs	Bill of Quantities
DWG	Drawings
GR	Growth Rate
ha	hectare
IDF	Intensity Duration Frequency
ILC	International Law Commission
IR	Inception Report
LM	Linear Meter
MEHE	Ministry of Education and Higher Education
MoA	Ministry of Agriculture
MoH	Ministry of Health
MoLG	Ministry of Local Government
NGO	Non-Governmental Organization
NIS	New Israeli Shekel
O&M	Operation and Maintenance
PCBS	Palestinian Central Bureau of Statistics
PNA	Palestinian National Authority
PRDP	Palestinian Reform and Development Plan
PSI	Palestinian Standard Institute
PRVs	Pressure Reducing Valves
PWA	Palestinian Water Authority
SoP	State of Palestine
ToR	Terms of References
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
UG	Universal Group for Engineering and Consulting
UNRWA	United Nations Relief and Work Agency
WASH	Water and Sanitation Hygiene
WBWD	West Bank Water Department
WHO	World Health Organization
WSSPS	Water Sector Strategic Planning Study
YWSD	Yatta Water Supply Department
YWSP	Yatta Water Supply System Project

1. INTRODUCTION

1.1 BACKGROUND

Palestine faces major issues and a great challenge towards the access and distribution of water throughout its territories. The West Bank suffers from water shortages, which affect directly the population served, but also indirectly the Palestinian economic development. Therefore, children in the State of Palestine (SoP), their families and communities require significant investments in the sustainability and maintenance of Water and Sanitation Hygiene (WASH) infrastructure for their needs to be addressed over the long-term.

Improving the water supply and distribution, in addition to the wastewater collection has positive impact on public health and quality of life for the communities in Palestine and wellbeing of children, as well as in promoting further commercial and industrial growth.

Few years ago, Yatta Water Supply System Project (YWSP) was implemented under the fund of USAID, but it was not completed.

The constructed YWSP consists of:

- (a) completed, but not assessed, works,
- (b) non-completed works,
- (c) supplied equipment and fittings but not tested, and
- (d) not-supplied works and equipment's.

At the time YWSP was halted, it had progressed to about 80% completion. The project components, as planned for in 2019, were:

Three New Reservoirs/tanks with all related mechanical, electrical and instrumentational components:

1. Khallet Saleem Reservoir, at grade 5,000 cubic meters' capacity.
2. Schools Reservoir, at Grade 1000 cubic meters' capacity.
3. Beit Emra Reservoir, elevated 500 cubic meters' capacity.

New Transmission and Distribution Pipelines:

- Construction of new main supply and distribution pipelines, from the reservoirs to the new distribution network/pipes, with an approximate total length of 21 km, using steel pipes of 150 mm, 200 mm, 250 mm and 300 mm.
- Construction of new distribution network/pipes and replacement and upsizing of the old network/pipes, with an approximate total length of 40 km, using steel pipes with sizes of 50 mm, 75 mm, 100 mm and 150 mm.

SCADA Monitoring system including, according to the Contract, the following items:

- Addition of specified control hardware and software. Input-Output (I/O) point connections.
- Wiring and wiring devices.
- Field instruments.
- Communication system and programming
- Training of WBWD/PWA and Yatta municipality staff on the Operation and Maintenance (O&M) of the system and its components.

1.2 PURPOSE OF THE DESIGN REPORT

In light of the consultancy assignment, a detailed design and full tender document was carried out to identify and design for the different project components including the remaining works related to the installed main transmission pipelines, distribution water networks, water pipes, chambers, reservoirs valves and spare part, etc.

The detailed design included as well all the recommendations resulting from the assessment study/report, initial ESIA, Preliminary design and the institutional and capacity building report.

1. Detailed design of the non-completed works of the project including all drawings, quantities and specifications of all project components, and how to integrate them within the already existing works.
2. Detailed design of the completed works of the project including all testing (sample testing, spot checks, verification) and remedies to be performed by the contractor. This shall be supported within the suitable drawings, quantities, and specificities.
3. Full list of all equipment and fittings at the municipality warehouse and the remedy programme and testing (sample testing, spot checks, verification) system to decide on the suitability of these fittings and equipment in the incorporation of the works. The list shall be supported with all testing (sample testing, spot checks, verification) done by the consultancy firm and the drawings and specifications of the fittings and equipment and the location for which to be incorporated.
4. Detailed design of the installed fittings and equipment of the project including all drawings, quantities and specifications of all project components. This shall be supported by any testing (sample testing, spot checks, verification) done by the consultancy firm and the remedies measures and testing (sample testing, spot checks, verification) system proposed to be done by the contractor.
5. Full list of missing fittings and equipment for the better completion of the works and the ideal functioning of the water supply system.
6. Final schedule and action plan
7. General and Particular Specifications
8. Full tender documents including the general and particular conditions, Drawings, supplementary documents etc.
9. Confidential cost estimate.

1.3 OBJECTIVES OF THE DESIGN REPORT

The present report aims to provide the basic design elements for the Yata Water Supply project (YWSP) in the south of West Bank, including some correction and complimentary measures. The preliminary design includes not only the design activities of works for YWSP but also capacity building activities.

The main objectives of the assessment tasks are to assess the completed and non-completed works under the project and to propose an efficient methodology and workplan to complete all project components as planned.

The main expected objectives/ outputs of the Preliminary Report are:

- 1) Identify and lists a detailed scope of works for the non-completed works and the additional works required.
- 2) Integrate the lists all the additional works required as an the impact of the stoppage period on the project components.
- 3) Integrate the lists all additional rehabilitation and adjustment needed.
- 4) Identify and lists a detailed scope for the changes to the design and layout of the works in order to reflect that on the tender documents.
- 5) Identify detailed lists a of new fittings and equipment needed for the project to be able to complete the project and operate it as planned.
- 6) Reflect the impact of any works done, by a third party on the works.

1.4 LIST OF TASKS UNDER ACTIVITY 6: FINAL DESIGN REPORT

Table 1 lists the activities of the consultancy assignment; tasks and sub tasks and the related output as per the TOR. For activities 5,6 and 8 (Final Design Report).

Table 1. List of Activities under Activity 5,6 and 8: Final Design Report

Activates/Tasks	Sub Task	Activities
Activity 5: Refine the existing designs and BoQs (As-built drawings) and Draft Final Design Report and drawings and draft tender documents	5.1	Preparation of detailed design of the project components: completed works, non-competed works, installed fittings and equipment, those fittings and equipment at the municipality stores and any missing equipment, supported with: <ul style="list-style-type: none"> All required Drawings, Specifications (Particular and General). BoQ's, Engineering cost Estimate Any testing (sample testing, spot checks, verification) and remedies programme to be performed by the contractor Additional requests based on the requirements through coordination with UNICEF Project Manager and its partners.
	5.2	Develop and produce a full tender document set including the Terms of Reference (TOR) containing design proposal, drawings, detailed specifications, BoQ, and tender documents for the contracting company who will be responsible for carrying out the construction works
Activity 6: Final Design Report and drawings and final tender documents	6.1	Updated and finalization of the Final Design Report and drawings and Final tender documents based on UNICEF, PWA, etc. Feedback.
Activity 8: Engineers estimate	8.1	Preparation of a confidential engineers estimate based on the local market survey and pricing of similar projects in term of type and size.

2. GENERAL SCOPE OF WORKS

With reference to the scope of works described in the terms of reference, and as per our assessment at the start of the project, the final scope of the works of the project used for this preliminary design is as follows:

Part 1: Yatta Water Supply Project (Works)- Detailed design and Tender Documents

- ❖ Design of the complimentary works for Yatta main transmission pipelines.
- ❖ Design of the complimentary works for Beit Emra 500m³ Elevated Reservoir.
- ❖ Design of the complimentary works for School Reservoir 1000m³ Reservoir.
- ❖ Design of the complimentary works for Khalet Salem Reservoir 5000m³ Reservoir.
- ❖ Reinstatement works (Asphalt, Concrete, etc.)
- ❖ Confirm strategic locations for flowmeters and monitoring chambers (Main Connections).
- ❖ Design of monitoring chambers (Main Connections).
- ❖ Design of SCADA for flowmeters and monitoring chambers (Main Connections).
- ❖ Design of SCADA for the three reservoirs (Beit Amra, Khalet Salem and School).
- ❖ Verify and specify all works such mobilization, demobilization, safety requirements etc.
- ❖ Identify and lists of spare parts including spare parts to cover the defect liability period as well as 5 years of operation.
- ❖ Confirm strategic locations for PRVs, Air Valves and Washout.
- ❖ Design of PRVs, Air Valves and Washout.

Part 2: Environmental Social Impact Assessment

- ❖ Environmental Assessment
- ❖ Full ESIA (Phase 2)
- ❖ Environmental and Social Management Plan (Phase 2)

3. HYDRAULIC STUDY

The aims of the hydraulic study for YWSP at Detailed Design stage were as follows:

- ❖ to check the implemented network carried out by USAID Project.;
- ❖ to design the new extension areas in Yatta city.
- ❖ to precise the location and the needs of Connection Chambers, PRV's, Air Valves and Washout.
- ❖ To identify the additional the quantity and type of material needed to complete the works.

3.1 HYDRAULIC DESIGN CRITERIA

Population was updated using 2017 Palestine Central Bureau of Statistics (PCBS) census with a 3.2% annual increase. Design year was taken as 2040. As planned earlier, seven communities will benefit from YWSP, including: Yatta, Beit Amra, Ziff, Al Heila, Wadi As-Sada, Khallet Al Maiyya, and Al Karmil.

Therefore, the population projections for these communities were considered for design projections and calculations of the water supply and demand for the Yatta communities. In addition, the villages of Hureiz, Biyar Al Arus, Qurnet Ar-Aras, Al Muntar, Izeiz and Qinan An-Najima are included in the population projections for the Yatta community.

The per capita water demand was selected utilizing WHO minimum recommended value of 100 liters per capita per day. A value of 120 liters per capita per day was selected to exceed the minimum requirements of WHO recommendation for domestic use based on the objectives of the Palestinian Water Authority. This value will include all domestic values considering commercial and industrial uses of water.

3.1.1 Industrial Consumption

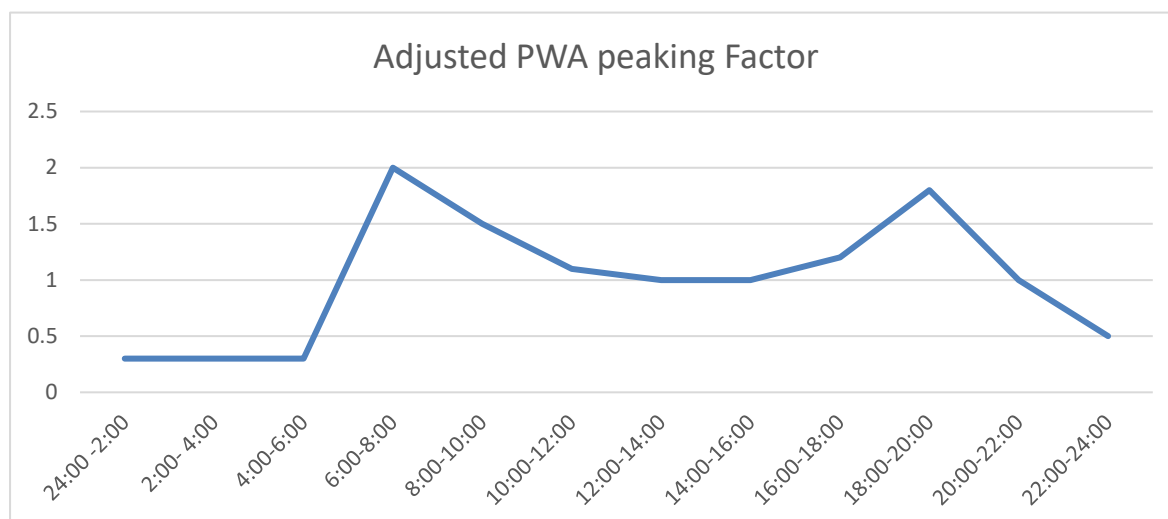
The design criteria for the Industrial consumptions shall be presented in Table 2.

Table 2. Industrial Consumption percentage according to PWA

	2020- 2021	2032	2040
Industrial consumption	4.3% of residential Consumption or current industrial consumption if bigger	7%	9%

3.1.2 Hourly demand pattern

The hourly demand pattern which were used are shown in figure 1.



Hour	24:00-2:00	2:00-4:00	4:00-6:00	6:00-8:00	8:00-10:00	10:00-12:00	12:00-14:00	14:00-16:00	16:00-18:00	18:00-20:00	20:00-22:00	22:00-24:00
PWA peaking Factor	0.5	0.3	0.5	2.0	1.5	1.1	1.0	1.1	1.2	2.0	1.3	0.8
Adjusted PWA peaking Factor	0.3	0.3	0.3	2.0	1.5	1.1	1.0	1.0	1.2	1.8	1.0	0.5

Source PWA, 2000

PWA peaking Factor adjustment made by MWH

Figure 1: Hourly demand pattern used for checking the hydraulic modelling

Considering the extensive use of storage tanks over the roofs of houses and the capacity of these storage tanks usually exceeds daily demands, the design was based on maximum daily flow and thus a peaking factor of 2.0 shall be utilized for transmission and distribution lines.

3.1.3 Seasonal peak flow

The seasonal peak flow is equal to 1.17 (in August).

3.1.4 Networks losses

Municipal water losses exceed 30% in most residential areas of the West Bank. Assuming the existing systems will be improved by 2040, these losses will be expected to reduce to about 15-20% in residential systems.

These losses have to be considered in the hydraulic calculations. Therefore, the total domestic use in distribution systems is assumed at 144 liters per capita per day and distribution systems will be checked for the existing and designed for the extension to deliver 144 liters per capita per day.

The design criteria for the network losses shall be presented in Table 3.

Table 3. Design Criteria- Network Losses

	2020- 2021	2045
Network Losses as a percentage of the Proposed demand (residential and Industrial)	15-20%	30%

The network losses for 2021 will be considered as 18% and 30% in 2040.

For the bulk water losses in domestic systems, 12% bulk system will be considered to deliver 160 liter per capita per day. Considering water shortages in the area, current (2015) demands were assumed at 120 liter per capita per day increasing to 136 liter per capita per day in 2025 before reaching the target design value of 160 liter per capita per day in 2040.

3.1.5 Pumping stations & Booster stations

There are no pumping stations in Yatta Water Supply system.

3.1.6 Max. Velocity

Pipes were checked and selected to maintain velocities and pressure heads within acceptable limits. For transmission lines, pipeline diameters were selected such that the maximum velocity is below 2 m/s.

3.1.7 Pressure

Transmission pipelines were designed to deliver water at demands points with a minimum pressure of 1.0 bar at connection points, while the maximum pressure was maintained at 25 bars which is the maximum rating of locally available pipe fittings. In this project it was found that the transmission lines and distribution lines could be maintained at pressures up to 16 bars.

For distribution networks the minimum pressure was maintained at 2.0 bar and the maximum at 8 bars. In cases when minimum pressure requirement contradicted the minimum velocity requirement, the minimum pressure criteria was the one taken into consideration.

3.2 PIPE DESIGN CRITERIA

In 2019, the project used the following specifications for the Pipe Materials:

- ❖ Carbon steel pipe and fittings with welded joints, cement lining, and extruded polyethylene coating that confirm to AWWA Standards C200- 216. Carbon SCH 40 steel pipe, ASTM A53, Type E, Grade B, plain end beveled, AWWA C215 extruded polyolefin coating, AWWA C205 cement mortar lining.
- ❖ The main transmission pipeline were constructed of carbon steel piping and fittings. Distribution piping in the villages were constructed of carbon steel pipes for diameters equal or larger than 75 mm, and galvanized steel piping and fittings with threaded joints and extruded polyethylene coating for sizes 25 mm and 50 mm.
- ❖ Galvanized steel piping and fittings with threaded joints were confirm to AWWA Standards C215. SCH40 steel pipe, ASTM A53, Type E (ERW), NTP Threaded, with AWWAC215 extruded polyolefincoating

- ❖ Steel pipes were imported to the West Bank from outside. The cement lining and protective coating were done locally. The manufacturing of steel pipes, their lining and protective coating is done in accordance with American Water Works Association standards. Therefore, all steel pipes in this project shall be manufactured in accordance with ANSI/AWWA C200-2013: AWWA Standards for steel water pipes- 6 Inch (150 mm) and larger.
- ❖ The design and installation of steel pipes were done in accordance with AWWA manual M11: Steel pipe- A guide for Design and Installation. Steel of these pipes were manufactured of steel sheets of grades specified in accordance with ASTM A570/A570 M.
- ❖ The cement mortar protective coating for the steel pipes were done in accordance with ANSI/AWWA C205-00: AWWA Standard for cement mortar protective lining and coating for steel pipes 4 inches (100 mm) and larger-shop applied.
- ❖ steel pipes with 75 mm in diameter were cement lined in accordance with local Palestinian Water Authority standards. Pipelines of 50 mm in diameter were galvanized with protective coating from outside in accordance with Palestinian Water Authority Standards.
- ❖ All steel pipes were rated to a pressure of at least 150% maximum operating pressure.

For completing the work, the Contractor will use the pipes and fittings available in PWA store house which were imported according the same specifications mentioned above.

For pipe installation, there is a considerable local experience in installing and laying out steel pipes in the West Bank with availability of technicians and workers experienced in welding steel pipes. In addition to that, the local engineers are also experienced in the installation and inspection of steel pipes and their welding.

3.3 POPULATION PROJECTION AND DEMAND

Population projections were based on population estimates by Palestinian Central Bureau of Statistics with annual growth rates of 3.2% as estimated by CBS for the area. Population projections for the seven communities under consideration are shown in Table 4.

Table 4: Population projections for 2025 and 2040 for the seven communities under consideration

Table 4. Population projections for 2025 and 2040 for the seven communities under consideration

#	Community Name	Population		
		2021	2025	2040
1	Yatta City	68,094	77,136	121,871
2	Khallet Maiyya	2,364	2,610	3, 771
3	Al Karmil	10,712	11,829	16,500
4	Al Heila	1,634	2,239	3,591
5	Wadi As Sada	505	699	1109
6	Beit Amra	3,967	4,381	7,088
7	Ziff	1,167	1,289	2,188

Based on the records of the year 2021, the total available water supply for the system was determined to have a current gap of about 5,033 m³/day) on the average consumption rate. Hence, additional water quantities need to be supplied for this project and/or water management plans have to be implemented. It should be noted that future demands will require additional supply, along with the West Bank Water Department (WBWD) managing the supply and the demand.

Therefore, and based on previous experiences, once project facilities are put into operation, it is anticipated that the presence of such new and modern water management structures and technologies may give the notion to the facility owner and/or operators (YMWD) that it is possible to manage the available water received by WBWD.

Based on population projections and the per capita demands, the total demands for the seven communities are listed in **Table 5**, assuming the per capita demand projections for the design years 2015, 2025 and 2040. The actual water for the project area were verified. Through models and professional judgment, the design was determined

Table 5. Water Supply and project Demand Forecast

	2021		2025		2040	
	Average Daily (m ³)	Maximum Daily (m ³)	Average Daily (m ³)	Maximum Daily (m ³)	Average Daily (m ³)	Maximum Daily (m ³)
Population Projections ¹	88,443		100,183		152,347	
Available Water Supply	3,950	NA	Unknown	Unknown	Unknown	Unknown
Projected Water Demand	10,613	15,920	13,624	20,437	24,375	36,562
Projected Project Supply: Surplus (+); Gap (-)	-5,033	Unknown	Unknown	Unknown	Unknown	Unknown

¹Populations based on 2017 PCBS Census with growth rate of 3.2%

The new project will increase the storage capacity from 6,220 m³ to 12,720 m³. This will improve the service of the drinking water supply as well as the operation of the network since the new reservoirs divided the network into additional service zones. **Figure 2** shows the hydraulic diagram for the new system with storage capacity information and water Resources.

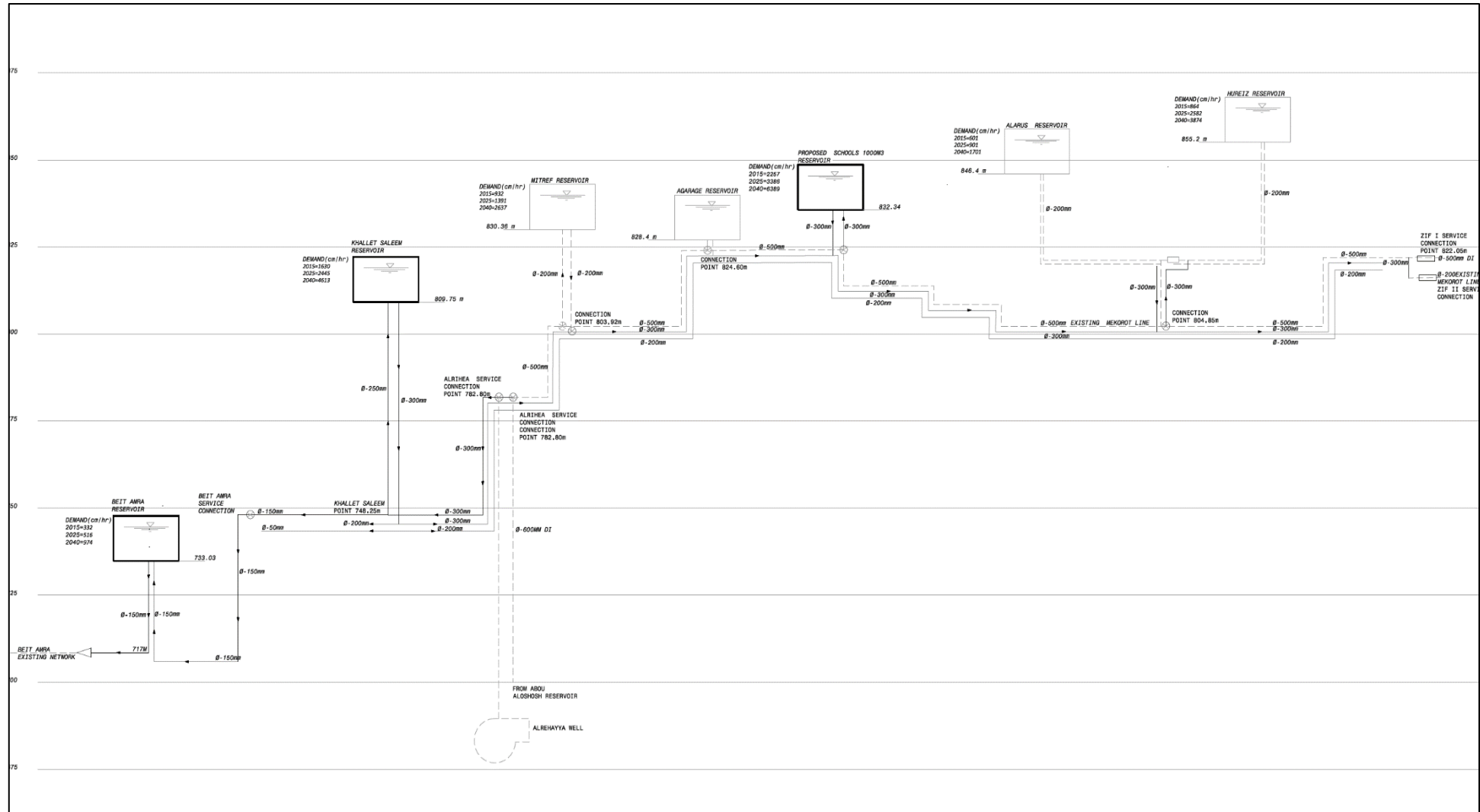


Figure 2: Yatta Water Supply System- Process Diagram

4. DETAILED DESIGN

This section aims to provide the basic design information about the various works concerned in the project. It should be read in conjunction with Appendix 1 to 4 which provide the layout and arrangements of the works, final BOQ and Specifications.

4.1 MAIN TRANSMISSION PIPELINES

In 2019, the project installed 94% of the transmission lines. In total, around 23.5 KM of transmission lines were installed. These pipe diameters vary between 150mm to 300mm. Table (6) shows the description of the pipe installed.

Table 6. Main Transmission Lines (Installed in 2019 Project)

	Diameter (mm)	Material	Length (m)	Tested
1	300	Steel	8,900	No
2	250	Steel	820	No
3	200	Steel	8050	No
4	150	Steel	5,700	No

Figure 3 and 4 Shows the layout of the existing (not Tested) transmission pipe line.

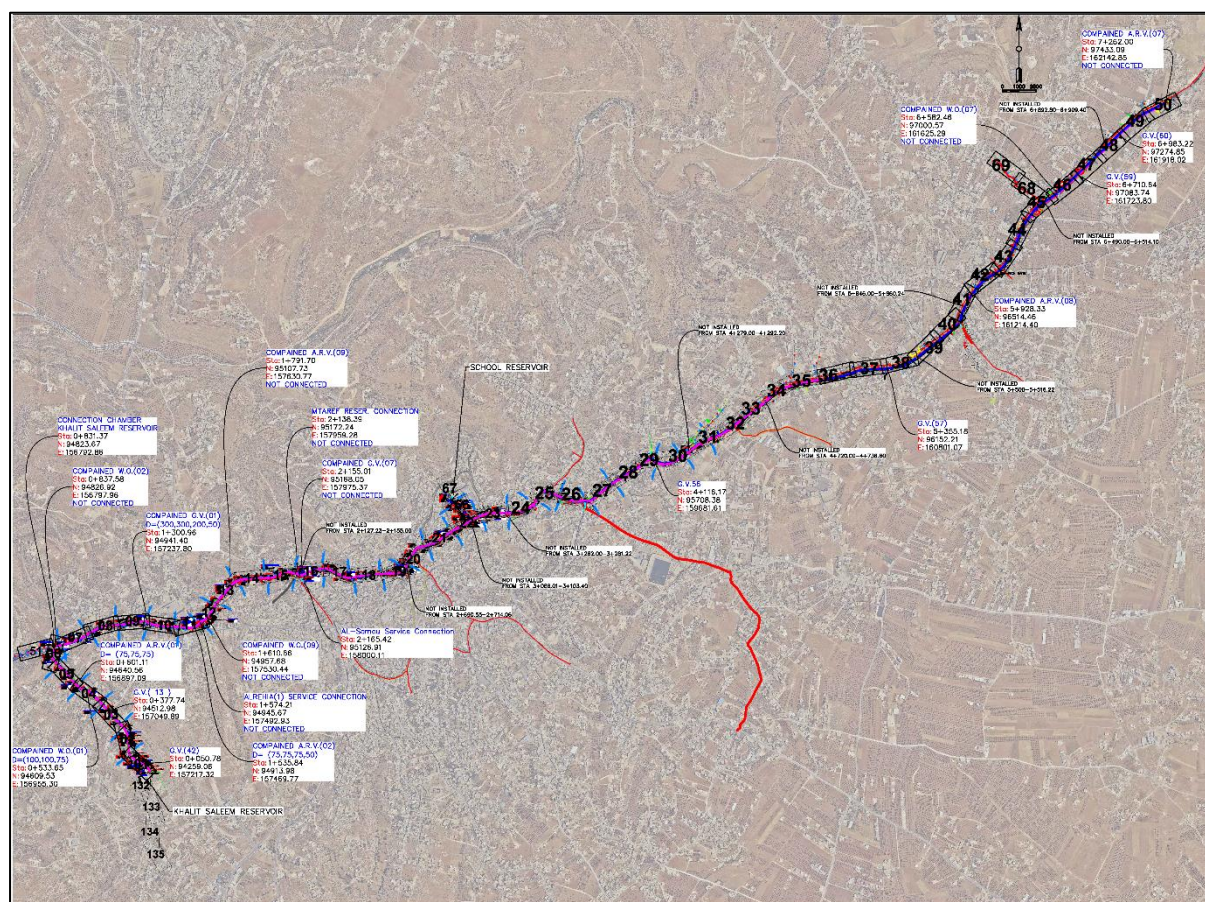


Figure 3: Main Transmission line Installed in 2019 (Part 1)

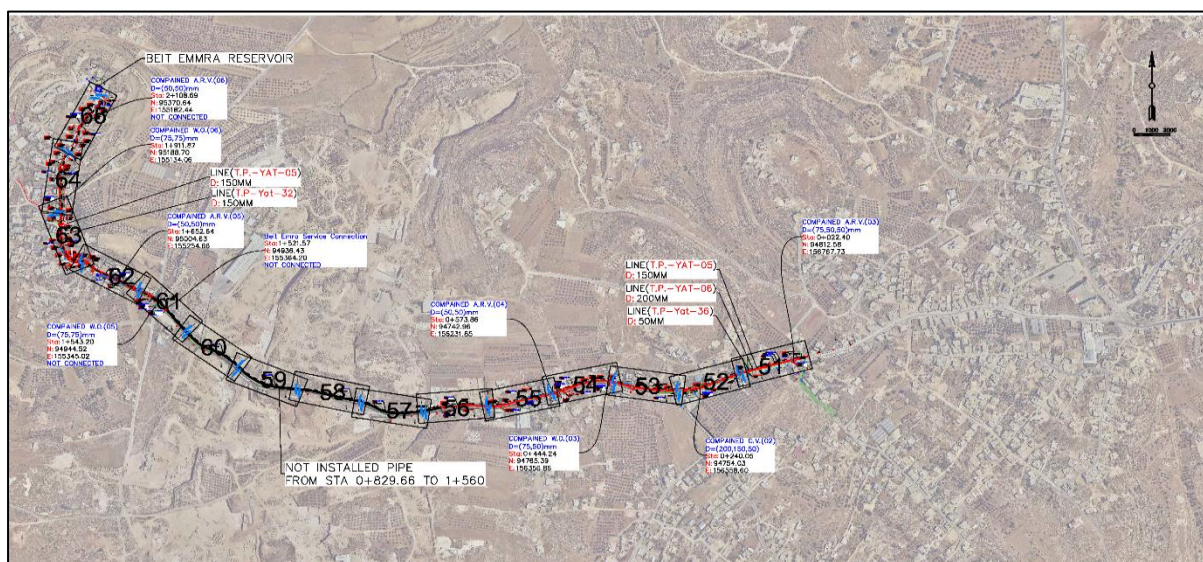


Figure 4: Main Transmission line Installed in 2019 (Part 2)

Currently, the transmission pipe line is not in operation. The remaining transmission pipe lines works are:

- ❖ Short pipe lines sections between the installed pipelines and the main connection chambers in addition to a short connection with the water source (500mm).
- ❖ Pipe lines connection between the installed transmission pipe lines and the valves chambers.
- ❖ Pipe line connection between the installed transmission pipe lines and Beit Ammra Elevated Tank.
- ❖ Pipe line connection between the installed transmission pipe lines and Khalet Salem Reservoir.
- ❖ Pipe line connection between the installed transmission pipe lines and School Reservoir.

In total, the remaining transmission pipe lines are 1,670 meters distributed in around 55 different locations. Table 7 shows the remaining transmission pipe lines works to complete the bulk system.

Table 7. Additional Works -Main Transmission Lines

	Diameter (mm)	Material	Length (m)	Availability of Pipes in PWA storage house
1	300	Steel	450	Available
2	250	Steel	25	Available
3	200	Steel	350	Available
4	150	Steel	750	Available

The required material for the implantation of these additional transmission pipe lines are available in PWA storage house.

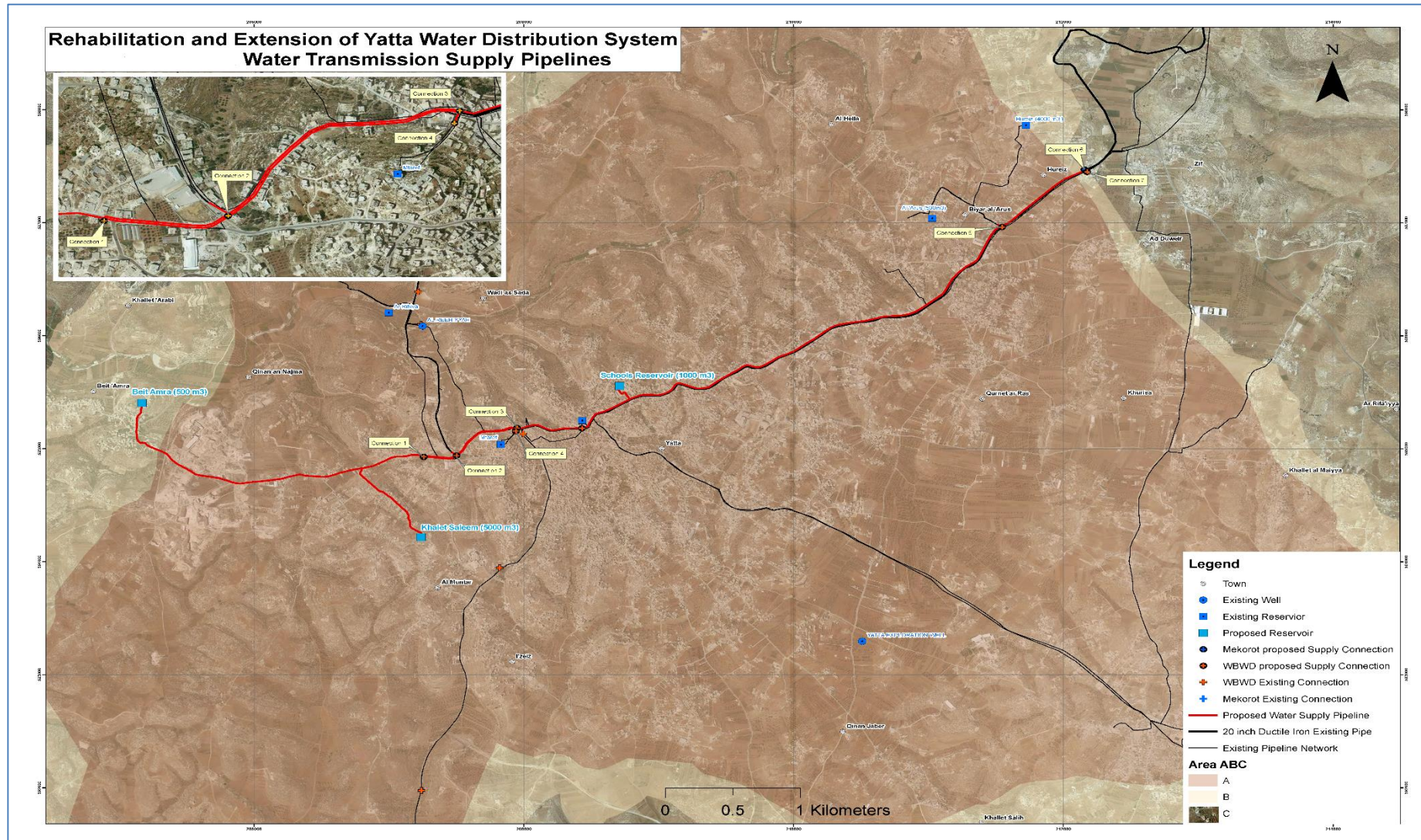


Figure 5: General Layout for Main Transmission line

4.2 DISTRIBUTION NETWORK

Several field visits and inventory diagnosis have been conducted with the present of YM. The purposes of these investigations are to review, analyze, organize and validate all the available data of the implemented (not operated) water network.

All existing information on past developments and on the present situation were obtained by a detailed review of all relevant existing reports, designs, drawings and documents that were made available.

The main problem is that the hydraulic model was not made available by the Employer nor YM. However, the consultant did his calculations to verify in general the new implemented (not operated) water network and did a detailed calculation for the additional pipe works which where are not in the original scope of 2018-2019 project.

In 2018-2019 Project, a total of 45,070m of distribution pipe lines were installed. Table 8 provides the details of these pipe lines.

Table 8. Distribution pipe lines

	Pipe Diameter	Length (m)
1	Steel Pipe and fittings, 150 mm	7235
2	Steel Pipe and fittings, 100 mm	19,185
3	Steel Pipe and fittings, 75 mm	5,870
4	Steel Pipe and fittings, 50 mm	12,780
Total		45,070

Additional and remining distribution water network works to complete the remining works and additional extension works are 12,450 meters. Table 9 lists the additional pipe lines works to complete distribution network.

Table 9. Supplementary Works –Distribution pipe lines

	Diameter (mm)	Material	Length (m)	Availability of Pipes in PWA storage house
1	150	Steel	650	Available
2	100	Steel	850	Available
3	75	Steel	650	Available
4	50	Steel	990	Only 650 m available
5	25	Steel	320	Available

The additional pipe quantities needed are available in the local market. The tender document shall consider the above-mentioned quantities.

The material of the additional pipe works shall be Steel Pipe Grade B.

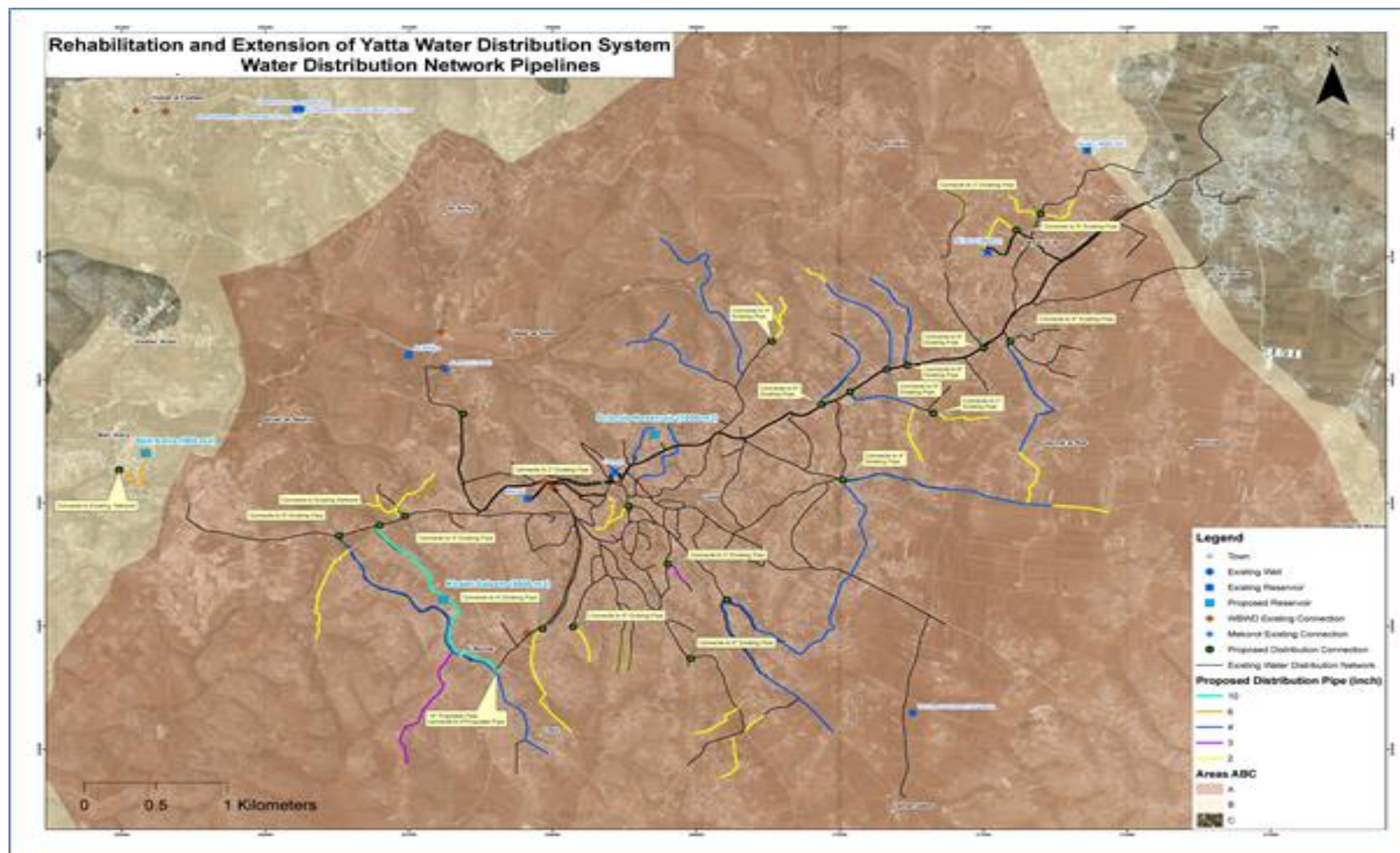


Figure 6: General Layout for the Distribution Network

4.3 EXTENSION AREA- ADDITIONAL PIPE WORKS

As part of the assessment of Yatta Water Network, the current coverage of the water network is between 80-85%. Table 9A shows the descriptions and details of these extension pipe lines.

In general, the extension will increase the water network coverage by 4-6% and shall serve around 2500-3000 Inhabitant.

The extension areas are located at five different locations within Yatta municipal boundary. These locations are Wadi Sada, Al Gawieta, Majid Baa, Uziaz and Al Hanu. Figure 6A shows the location of the extension areas.

Table 10A. Extension of Water Network pipe lines

	Diameter (mm)	Material	Length (m)
1	Pipe Diameter 6 Inch	Steel	2,800
2	Pipe Diameter 4 Inch	Steel	1,065
3	Pipe Diameter 3 Inch	Steel	5,310
4	Pipe Diameter 2 Inch	Steel	1,450
5	Pipe Diameter 1 Inch	Steel	2,000

The extension pipelines work will cover only the main lines and lateral lines. The House connections will be the responsibility of Yatta Municipality. The design (Drawings and BOQ) included all required works such as excavation, backfilling, supply/ installation of pipe reinstatement, valves, etc.

The original scope of works for YWSP did not include these extension works. However, the consultant and based on the assessment of the YWDP and Yatta water network recommended these extensions to be part of the scope of works (the works Contract).

The water network extension works with all its components are covered under a separate Bill10 (distribution Networks- Extension area). The total cost of this components (bill 10) is 1,030,560 Euro.

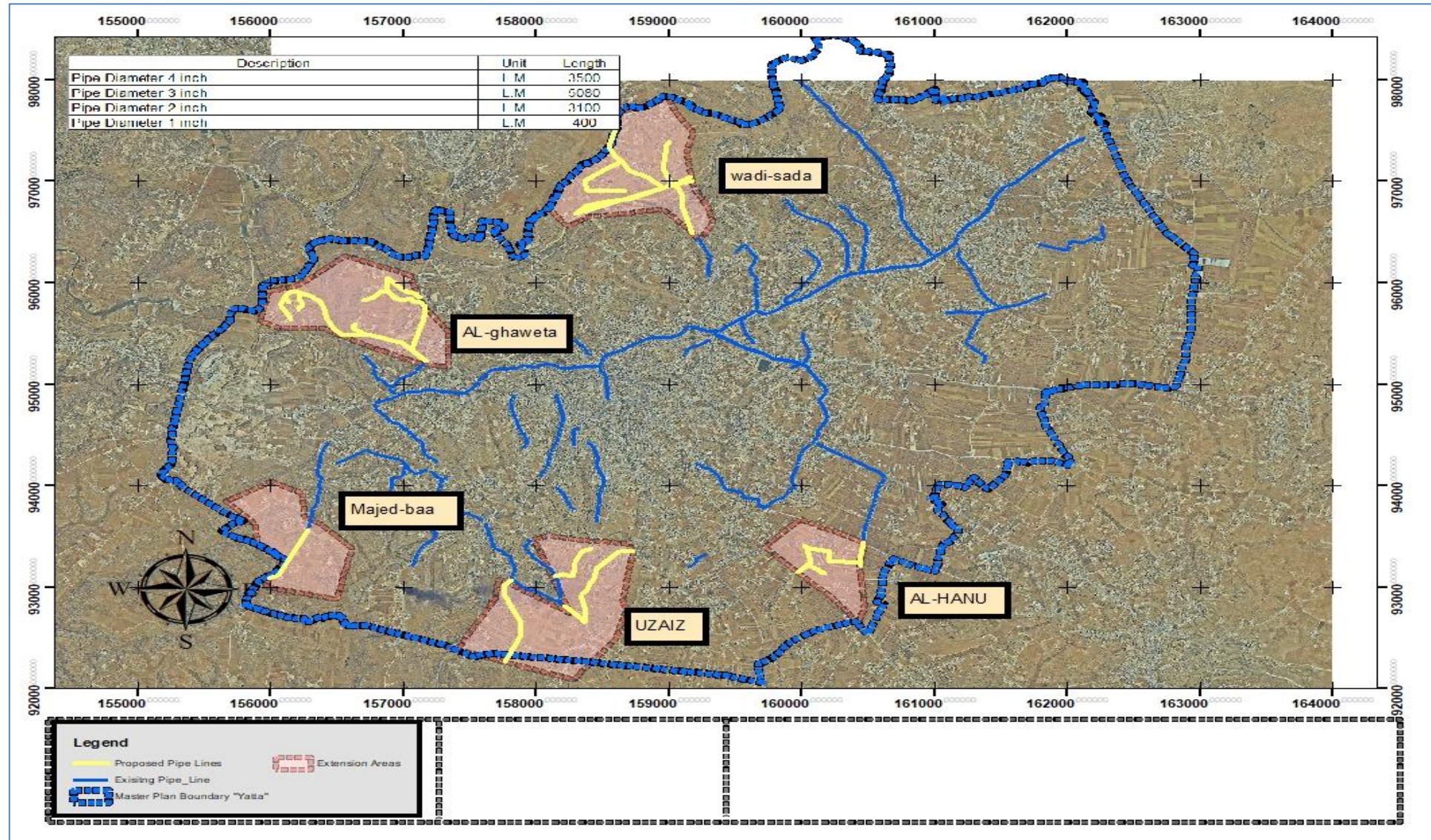


Figure 6A: Extension Area- additional Pipe Works

4.4 ASPHALT REINSTATMENT WORKS

Asphalt reinstatement is a main component in the remaining works under YWSP. There are significant sections which were left without reinstatement and other sections have only one layer of asphalt.

The reinstatement works in the BoQs of the original project were presented in several methods of measurements. The non-completed works include: Reinstatement works with two layers of asphalt for different trench widths. Only one layer was completed for around 18,500 m. The second layer for these has to be completed in addition to 28,800 m of reinstatement with two asphalt layers.

Based on our survey of the sections that will need asphalt reinstatement, YWSP will need around 140,000 m² of asphalt (6 cm thickness). These asphalt reinstatements are distributed in a several locations. Figure 7 the routs of asphalt reinstatement.

4.5 CLEANING, WASHING, HYDRAULIC TEST PRESSURE TESTING

Hydrostatic pressure test for steel pipes test shall be done for all the installed pipes in 2019 project as well as the new pipes which will be installed in the new YWSP. The Tender Document of the completion project will have items to make pressure tests for all the installed pipes. Special conditions and BOQ items will be considered in order to mitigate all the possible risks coming from the not tested steel pipes.

The total expected pressure test is between 72-75 Km. supporting items are specified in the detailed design phase in order to repair any potential defects discovered during the pressure tests.

Cleaning, washing, and disinfection for the entire pipelines in the project will also be considered.

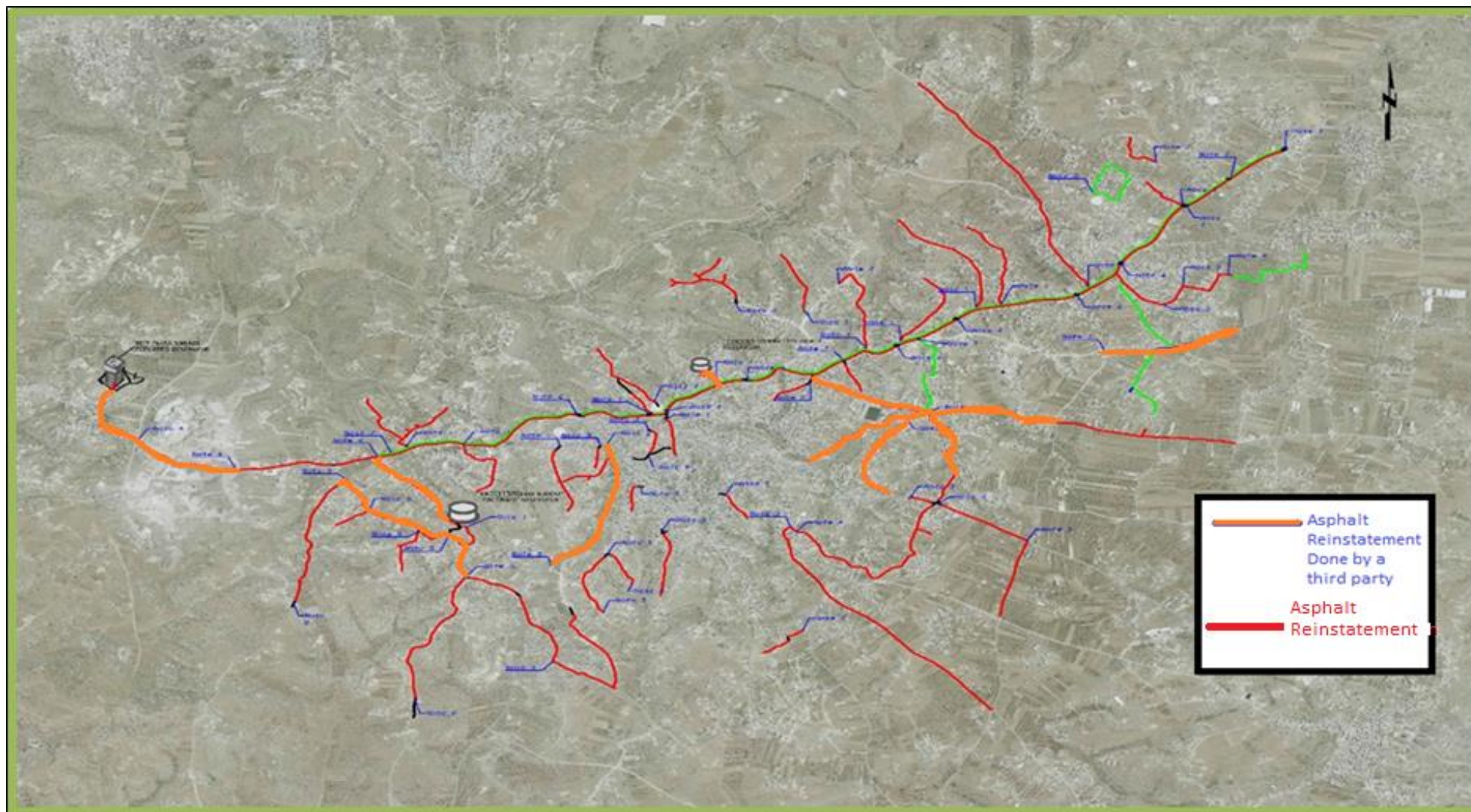


Figure 7. The Reinstatement works done by Yata municipality and other parties

4.6 VALVE CHAMBERS

4.6.1 Isolation Valves

The total number of Isolation valves are 118. The diameters of these isolation valves are various between 50mm to 300mm. Table 10 lists the isolation valves proposed.

Table 11. Isolation Valve in Chamber

	Size (mm)	No.	Availability of Valves and fittings in PWA storage house
1	50mm	48	Yes
2	75mm	15	Yes
3	100mm	32	Yes
4	150mm	14	Yes
5	200	1	Yes
6	300	8	Yes

As stated in the above table, most of the valves and fittings related to the isolation valves are available in PWA storage house.

4.6.2 PRVs

The hydraulic analysis recommended the implementation and installation of 4 PRV's distributed amount Yatta water supply network. each PRV chamber will have a by pass with other PRV for Maintenances.

Table 11 describe the PRV's diameters and rating. The location of these PRV are shown in Figure 8.

Table 12. Pressure Reducing Valve

	Description	Size (mm)	PN (Bar)	Bypass	Availability of Valves and fittings in PWA storage house
1	P.R.V. (01)	80mm	16	Yes	Yes
2	P.R.V. (02)	80mm	16	Yes	Yes
3	P.R.V. (03)	80mm	16	Yes	Yes
4	P.R.V. (04)	150mm	25	Yes	Yes

As stated in the above table, most of the valves and fittings related to the PRV valves are available in PWA storage house.

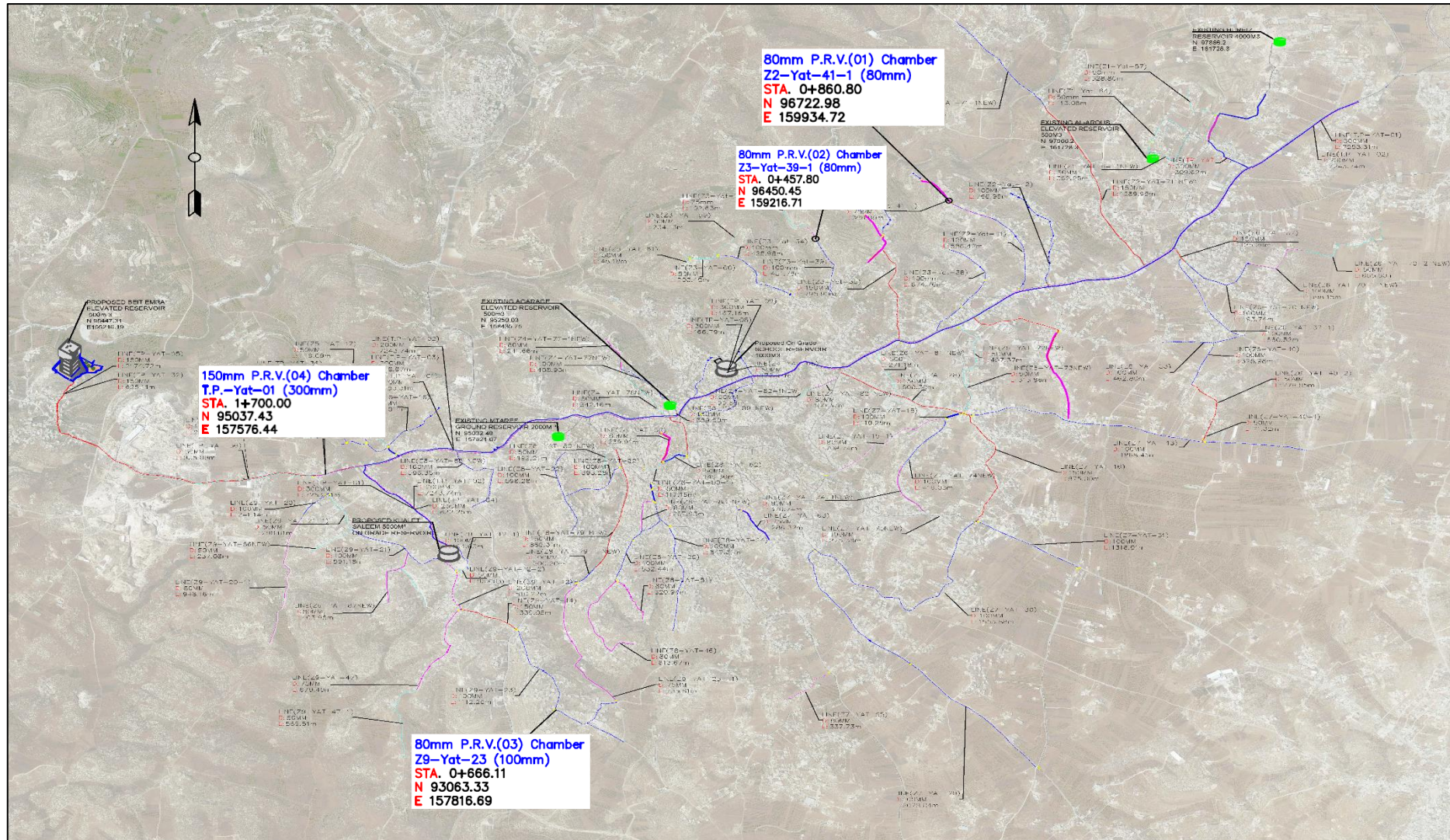


Figure 8: Pressure Reducing Valve locations

4.6.3 Air Valves

The design proposes 33 air valves distributed at different locations in Yatta water supply network. Most of the concrete chambers for the air valves are constructed. The remaining works are mainly the installation of the mechanical equipment's, steel pipe short pieces, reinstatement, vent, ladder etc. Table 12 summarizes the air valves diameters and locations.

Table 13. Air Release Valve

	Description	Size (mm)	No.	Availability of Valves and fittings in PWA storage house
1	A.R.V.(01)	A.R.V 50MM	23	Yes
2	A.R.V.(02)	A.R.V 80MM	10	Yes

As stated in the above table, most of the valves and fittings related to the Air Valves are available in PWA storage house.

4.6.4 Wash out

The total Number of Wash out are 21. Table 13 shows the description of these Wash outs. As stated in below table, most of the valves and fittings related to the Wash out valves are available in PWA storage house.

Table 14. Wash out Valve

	Description	Size (mm)	No.	Availability of Valves and fittings in PWA storage house
1	W.O.-01	A.R.V 50MM	23	Yes
2	W.O.-02	A.R.V 80MM	10	Yes

4.7 COMPLEMENTARY WORKS: BEIT AMMRA 500M³ ELEVATED TANK

Beit Ammra is a concrete elevated reservoir located in Beit Ammra west of Yatta City. The concrete works were constructed and completed in 2019. The elevated tank is currently not in operation. The civil works in Beit Emra elevated tank are 100% completed. The remaining works are related to mechanical and electrical works, SCADA, miscellaneous, disinfection and commissioning.

Table 14 summarizes the remining activates and its status in the preliminary design phase.

Table 15. Beit Ammra Elevated Tank- preliminary designed activates

	Description	Percentage of Completion	Preliminary Designed	Availability of materials in PWA storage house
1	Concrete Works	100%	-	-
2	Mechanical Works	10 %	Yes	Yes
3	Repair and remedy work	0%	Yes	No
4	Electrical works including SCADA	5%	Yes	Yes
5	Miscellaneous	-	Yes	No
6	Testing and commissioning	0%	Yes	No

The Project will complete all the remining works in Beit Ammra Elevated Tank and put in operation.

4.8 COMPLEMENTARY WORKS: SCHOOL TANK 1000M³ RESERVOIR

Schools reservoir is a concrete on ground tank located near the downtown of Yatta City. The concrete works were constructed and completed in 2019. The tank is currently not in operation. The civil works are 100% completed. The remaining works are related to mechanical and electrical works and miscellaneous works. Table 15 summarizes the remining activates and its status in the preliminary design phase.

Table 16. School Tank- preliminary designed activates

	Description	Percentage of Completion	Preliminary Designed	Availability of materials in PWA storage house
1	Concrete Works	100%	-	-
2	Mechanical Works	15 %	Yes	Yes
3	Repair and remedy work	0%	Yes	No
4	Electrical works including SCADA	0%	Yes	Yes
5	Miscellaneous	-	Yes	No
6	Testing and commissioning	0%	Yes	No

The Project will complete all the remining works in School reservoir and put in operation.

4.9 COMPLEMENTARY WORKS: KHALET SALEM 5000M³ RESERVOIR

Khalet Salem reservoir is a concrete on ground tank located west of Yatta City. The concrete works were constructed and completed in 2019. The tank is currently not in operation. The civil works are 85% completed. The remaining works are related to mechanical works, electrical works, civil works related to landscaping and miscellaneous works.

Table 16 summarizes the remining activates and its status in the preliminary design phase.

Table 17. Khaket Salem- preliminary designed activates

	Description	Percentage of Completion	Preliminary Designed	Availability of materials in PWA storage house
1	Concrete Works	85%	Yes	No
2	Mechanical Works	5 %	Yes	Yes
3	Repair and remedy work	0%	Yes	No
4	Electrical works including SCADA	0%	Yes	Yes
5	Miscellaneous	-	Yes	No
6	Testing and commissioning	0%	Yes	No

The Project will complete all the remining works in Khalet Salem reservoir and put in operation.

4.10 COMPLEMENTARY WORKS: EQUIPPING EXISTING CHAMBERS

According to project documents and the assessment conducted, the total number of chambers which were completed or partially completed are 128. This includes the isolation valves in precast or cast in site manholes/champers, Air Valves, Washout Valves, service connection valves, main connection valves and Pressure Reducing Valves (PRVs).

The general statement regarding the manholes is that all chambers are in good conditions. The testing sample was randomly selected for the applicable chambers to cover 10 out of 24 partially completed reinforced concrete cast-in-place chambers and 20 out of 104 partially completed pre-cast reinforced concrete chambers. These are assessed under section 3.3.

Several problems and obstacles were encountered. These problems are:

- Most of the manholes does not have internal stairs.
- Most of the manholes are full of dirts and water.

All the observations in the assessment report were preliminary designed and included in the BOQ/CE. The list of the complementary works for these chambers are presented in figures 9-13.

No.	BOQ Item	Description	Chmber ID	Location	Station								
						Bitumen Coating	Backfilling	Cover	Vent Pipe	Fixed Ladder	Reinstatement	Completed external connection	Valves Installation
1	2.2.1.14	300, 300, 200, 50mm Gate Valve Chamber	GV-01	TP-YAT-01, 02, 03& 33	1+304	Done	Done	Done	Done /without screen mesh	Not Done	Not Done	Done	Not Done
2	2.2.1.15	300,200,50mm Combined Gate Valve	GV-07	TP-YAT-01,02&33	2+146.42	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
3	2.2.1.16	200,150,50mm Combined Gate Valve	GV-02	TP-YAT-05,06&36	0+261	Done	Done	Done	Done /without screen mesh	Not Done	Not Done	Done	Not Done
4	2.2.2.6	75,75,75mm Combined Air Valve Chamber	A.R.V.01	TP-YAT-01, 02 & 04	0+596.01	Done	Done	Done	Done /without screen mesh	Not Done	Done	Done	Not Done
5	2.2.2.8	75, 75, 75, 50mm Air Valve Chamber	A.R.V.02	TP-YAT-01, 02, 03& 33	1 +527.92	Done	Done	Done	Not Done	Not Done	Not Done	Done	Not Done
6	2.2.2.10	75, 75, 50mm Air Valve Chamber	A.R.V. 09	TP-YAT-01,02&33	1+774.99	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
7	2.2.2.10	75, 75, 50mm Air Valve Chamber	A.R.V. 07	TP-YAT-01,02&33	7+246.77	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
8	2.2.2.10	75, 75, 50mm Air Valve Chamber	A.R.V.08	TP-YAT-01,02&33	5+934	Done	Done	Done	Done /without screen mesh	Not Done	Not Done	Done	Not Done
9	2.2.2.12	75, 50, 50mm Air Valve Chamber	A.R.V. 03	TP-YAT-05,06&36	0+013	Done	Done	Done	Done /without screen mesh	Not Done	Not Done	Done	Done
10	2.2.2.14	50, 50mm Air Valve Chamber	A.R.V. 04	TP-YAT-05&36	0+571	Done	Done	Done	Done /without screen mesh	Not Done	Not Done	Done	Done
11	2.2.2.14	50, 50mm Air Valve Chamber	A.R.V. 05	TP-YAT-05&32	1+651	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
12	2.2.2.14	50, 50mm Air Valve Chamber	A.R.V. 06	TP-YAT-05&32	2+129	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
13	2.2.3.6	100, 75, 50mm Combined Washout Chamber	W.O.09	TP-YAT-01, 02 & 33	1+603.13	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
14	2.2.3.6	100, 75, 50 mm Combined Washout Chamber	W.O. 07	TP-YAT-01,02&33	6+575	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
15	2.2.3.8	100, 100, 75mm Combined Washout Chamber	W.O.01	TP-YAT-01, 02 & 04	0+539.11	Done	Done	Done	Done /without screen mesh	Not Done	Done	Done	Done
16	2.2.3.10	100,100,75, 50 mm Combined Washout Chamber	W.O-02	TP-YAT-01,02,03&33	0+833.53	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
17	2.2.3.14	75, 50mm Combined Washout Chamber	W.O.03	TP-YAT-05&36	0+436	Done	Done	Done	Done /without screen mesh	Not Done	Not Done	Done	Done
18	2.2.3.16	75 and 75 mm Washout Chamber	W.O. 06	TP-YAT-05&32	1+901	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
19	2.2.3.16	75 and 75 mm Washout Chamber	W.O. 05	TP-YAT-05&32	1+540	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
20	2.2.4.2.1	150mm pipe for Beit Emra Service Connection Chamber	Service Connection Chamber	TP-YAT-05&32	1+535	Not Done	Not Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
21	2.2.4.2.4	250mm pipe for Samou service connection (CP-071)	Service Connection Chamber	TP-YAT-01,02&33	2+160	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
22	2.2.4.2.5	300mm pipe for Al rihya I connection (CP-072)	Service Connection Chamber#01	TP-YAT-03	1+578	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
23	2.2.5.1.10	300,250mm pipes for Mataref Reservoir Connection Chamber	Connection chamber	TP-YAT-01,02&33	2+129.29	Done	Done	Done	Not Done	Not Done	Not Done	Not Done	Not Done
24	2.2.5.1.12	300,250mm pipes for Khallet Saleem Reservoir Connection Chamber	Connection chamber	TP-YAT-01,&04	0+825.00	Done	Done	Done	Not Done	Not Done	Not Done	Done/ one side from 3 sides	Not Done
25	4.2	School Vault Chamber	Reservoir Valve Vault	School Reservoir Yard	Yard	Done	Done	Done	Done /without screen mesh and paint	Done	Not Done	Partial connection	Not Done
26	4.1	School Reservoir WO chamber	School Reservoir	Yard	Yard	Done	Done	Done	Not Done	Not Done	Not Done	Partial connection	Done

Figure 9. Cast In situ Chamber- remining works for each chamber

No.	BOQ Item	Description	Chmber ID	Location	Station	Installation	Cover	Vent	Step Ladder	Reinstatement	Completed external connection	Valves Installation
1	2.2.1.9	2" Gate Valve Chamber-	G.V.42	TP-YAT-02	0+090.32.	Done	Done	NA	Not Done	Done	Done	Done
2	2.2.1.9	2" Gate Valve Chamber	G.V.13	TP-YAT-02	0+424.86.	Done	Done	NA	Not Done	Done	Done	Done
3	2.2.1.9	2" Gate Valve Chamber	G.V.01	Z1-YAT-57	0+003.42	Done	Done	NA	Not Done	Not done	Done	Done
4	2.2.1.9	2" Gate Valve Chamber	G.V.02	Z1-YAT-64-1	0+003.72	Done	Done	NA	Not Done	Not done	Done	Done
5	2.2.1.9	2" Gate Valve Chamber	G.V.03	Z1-YAT-64	0+038.24	Done	Done	NA	Not Done	Not done	Done	Done
6	2.2.1.9	2" Gate Valve Chamber	G.V.59	TP-YAT-33	6+704.20	Done	Done	NA	Not Done	Not done	Done	Done
7	2.2.1.9	2" Gate Valve Chamber	G.V.60	TP-YAT-33	6+974.60	Done	Done	NA	Not Done	Not done	Done	Done
8	2.2.1.9	2" Gate Valve Chamber	G.V.15	Z6-YAT-40	0+326.25	Done	Done	NA	Not Done	Not done	Done	Done
9	2.2.1.9	2" Gate Valve Chamber	G.V.16	Z6-YAT-40-2	0+009.23	Done	Done	NA	Not Done	Not done	Done	Done
10	2.2.1.9	2" Gate Valve Chamber	G.V.11	Z6-YAT-37-1	0+043.68	Done	Done	NA	Not Done	Not done	Done	Done
11	2.2.1.9	2" Gate Valve Chamber	G.V.12	Z6-YAT-37-1	0+212.32	Done	Done	NA	Not Done	Not done	Done	Done
12	2.2.1.9	2" Gate Valve Chamber	G.V.14	Z6-YAT-37-1	0+668.0	Done	Done	NA	Not Done	Not done	Done	Done
13	2.2.1.9	2" Gate Valve Chamber	G.V.18	Z6-YAT-70	0+292	Done	Done	NA	Not Done	Not done	Done	Done
14	2.2.1.9	2" Gate Valve Chamber	G.V.17	Z7-YAT-13	0+471	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
15	2.2.1.9	2" Gate Valve Chamber	G.V.24	Z7-YAT-30	0+197	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
16	2.2.1.9	2" Gate Valve Chamber	G.V.61	Z7-YAT-30	0+255	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
17	2.2.1.9	2" Gate Valve Chamber	G.V.25	Z7-YAT-30	0+511	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
18	2.2.1.9	2" Gate Valve Chamber	G.V.26	Z7-YAT-30	0+970	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
19	2.2.1.9	2" Gate Valve Chamber	G.V.27	Z7-YAT-30	1+131	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
20	2.2.1.9	2" Gate Valve Chamber	G.V.28	Z7-YAT-30	1+529	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Not Done
21	2.2.1.9	2" Gate Valve Chamber	G.V.29	Z7-YAT-29	0+130	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
22	2.2.1.9	2" Gate Valve Chamber	G.V.30	Z7-YAT-29	0+268	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
23	2.2.1.9	2" Gate Valve Chamber	G.V.05	Z3-YAT-35	0+703	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
24	2.2.1.9	2" Gate Valve Chamber	G.V.07	Z3-YAT-59	0+043	Done	Not done	NA	Not Done	Not done	Done	Done
25	2.2.1.9	2" Gate Valve Chamber	G.V.04	Z3-YAT-35	0+220	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done

Figure 10. Precast Manholes/Chambers- remining works for each chamber (Part 1)

Installed Precast Chambers LOG - Along T.P.L and Networks												
No.	BOQ Item	Description	Chmber ID	Location	Station	Installation	Cover	Vent	Step Ladder	Reinstatement	Completed external connection	Valves Installation
26	2.2.1.9	2" Gate Valve Chamber	G.V06	Z3-YAT-35	0+060	Done	Done	NA	Not Done	Not done	Not Done - not connected to existing	Done
27	2.2.1.9	2" Gate Valve Chamber	G.V 20	Z7-YAT-81	0+003	Done	Done	NA	Not Done	Not done	Not Done - not connected to new T.P.L	Done
28	2.2.1.9	2" Gate Valve Chamber	G.V.057	TP-YAT-33	5+347	Done	Done	NA	Not Done	Not done	Done	Done
29	2.2.1.9	2" Gate Valve Chamber	G.V.058	TP-YAT-33	6+080	Done	Done	NA	Not Done	Not done	Done	Done
30	2.2.1.9	2" Gate Valve Chamber	G.V.019	Z7-YAT-72	0+003	Done	Done	NA	Not Done	Not done	Not Done - not connected from both sides	Not done
31	2.2.1.9	2" Gate Valve Chamber	G.V.031	Z7-YAT-29	0+896	Done	Done	NA	Not Done	Not done	Not Done - not connected from both sides	Not done
32	2.2.1.9	2" Gate Valve Chamber	G.V.56	TP-YAT-33	4+105	Done	Not done	NA	Not Done	Not done	Not Done - not connected from both sides	Done
33	2.2.1.10	3" Flanged Gate Valve Chamber	G.V.03	Z6-YAT-70-1	0+009.46	Done	Done	Done	Not Done	Not done	Done	Done
34	2.2.1.10	3" Gate Valve Chamber	G.V.01	Z3-YAT-60	0+010	Done	Done	Done	Not Done	Not done	Done	Done
35	2.2.1.10	3" Gate Valve Chamber	G.V.05	Z7-YAT-73	0+775	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-28	Done
36	2.2.1.10	3" Gate Valve Chamber	G.V.02	Z4-YAT-82	0+010	Done	Not done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not done
37	2.2.1.10	3" Gate Valve Chamber	G.V.07	Z7-YAT-31	0+638	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not done
38	2.2.1.10	3" Gate Valve Chamber	G.V.06	Z7-YAT-15-1	0+005	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not Done
39	2.2.1.11	4" Gate Vave Chambetr	G.V.022	Z7-YAT-74	0+007	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not Done
40	2.2.1.11	4" Gate Valve Chamber	G.V.35	Z9-YAT-12-1	0+007.57	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new T.P.L	Not Done
41	2.2.1.11	4" Gate Valve Chamber	G.V.29	Z8-YAT-79-1	0+880.00	Done	Not done	Not done	Not Done	Not done	Done	Done
42	2.2.1.11	4" Gate Valve Chamber	G.V.31	Z8-YAT-52	0+030.00	Done	Done	Not done	Not Done	Not done	Done	Done
43	2.2.1.11	4" Gate Valve Chamber	G.V.15	Z6-YAT-40	0+004.7	Done	Done	Done	Not Done	Not done	Done	Done
44	2.2.1.11	4" Gate Valve Chamber	G.V.13	Z6-YAT-53	0+293.48	Done	Done	Done	Not Done	Not done	Done	Done
45	2.2.1.11	4" Gate Valve Chamber	G.V.14	Z6-YAT-53	0+004.32	Done	Done	Done	Not Done	Not done	Done	Done
46	2.2.1.11	4" Gate Valve Chamber	G.V 10	Z6-YAT-37-1	0+005.62	Done	Done	Done	Not Done	Not done	Done	Done
47	2.2.1.11	4" Gate Valve Chamber	G.V 12	Z6-YAT-37	0+103.17	Done	Done	Done	Not Done	Not done	Not Done - not connected to new T.P.L	Done
48	2.2.1.11	4" Gate Valve Chamber	G.V.25	Z7-YAT-30	0+774	Done	Done	Not done	Not Done	Not done	Done	Done
49	2.2.1.11	4" Gate Valve Chamber	G.V.26	Z7-YAT-30	1+525	Done	Done	Not done	Not Done	Not done	Done	Done
50	2.2.1.11	4" Gate Valve Chamber	G.V.51	Z1-YAT-71	0+080	Done	Done	Not done	Not Done	Not done	Not Done - not connected to existing	Done

Figure 11. Precast Manholes/Chambers- remining works for each chamber (Part 2)

No.	BOQ Item	Description	Chmber ID	Location	Station	Installation	Cover	Vent	Step Ladder	Reinstatement	Completed external connection	Valves Installation
51	2.2.1.11	4" Gate Valve Chamber	G.V.01	Z2-YAT-42	0+007	Done	Done	Done	Not Done	Not done	Not Done - not connected to new T.P.L	Done
52	2.2.1.11	4" Gate Valve Chamber	G.V.02	Z2-YAT-41	0+011	Done	Not done	Not done	Not Done	Not done	Not Done - not connected to new T.P.L	Done
53	2.2.1.11	4" Gate Valve Chamber	G.V.03	Z3-YAT-38	0+014	Done	Done	Done	Not Done	Not done	Not Done - not connected to new T.P.L	Done
54	2.2.1.11	4" Gate Valve Chamber	G.V.27	Z7-YAT-29	0+007	Done	Done	Not done	Not Done	Not done	Done	Done
55	2.2.1.11	4" Gate Valve Chamber	G.V.04	Z3-YAT-35	0+793	Done	Done	Done	Not Done	Not done	Done	Done
56	2.2.1.11	4" Gate Valve Chamber	G.V.06	Z3-YAT-34	0+005	Done	Done	Not done	Not Done	Not done	Not Done - not connected to existing	Done
57	2.2.1.11	4" Gate Valve Chamber	G.V.019	Z7-YAT-15	0+004	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-28	Done
58	2.2.1.11	4" Gate Valve Chamber	G.V.018	Z7-YAT-13	0+770	Done	Done	Done	Not Done	Not done	Not Done - not connected to new YAT-13	Done
59	2.2.1.11	4" Gate Valve Chamber	G.V.024	Z7-YAT-31	0+639	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not done
60	2.2.1.11	4" Gate Valve Chamber	G.V.017	Z7-YAT-13	0+013	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not done
61	2.2.1.11	4" Gate Valve Chamber	G.V.21	Z7-YAT-31	0+022	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not done
62	2.2.1.11	4" Gate Valve Chamber	G.V.11	Z6-YAT-37	0+071	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Done
63	2.2.1.11	4" Gate Valve Chamber	G.V.08	Z5-YAT-18	0+030	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not done
64	2.2.1.12	6" Gate Valve Chamber	G.V.06	Z8-YAT-79	0+030.05	Done	Not done	Not done	Not Done	Not done	Done	Done
65	2.2.1.12	6" Gate Valve Chamber	G.V.01	Z1-YAT-71	0+034	Done	Done	Done	Not Done	Not done	Not Done - not connected to new T.P.L	Done
66	2.2.1.12	6" Gate Valve Chamber	G.V.03	Z6-YAT-37	0+007	Done	Done	Not done	Not Done	Not done	Done	Done
67	2.2.1.12	6" Gate Valve Chamber	G.V.02	Z3-YAT-35	0+007	Done	Done	Done	Not Done	Not done	Not Done - not connected to new T.P.L	Done
68	2.2.1.12	6" Gate Valve Chamber	G.V.05	Z7-YAT-16	0+005	Done	Done	Not done	Not Done	Not done	Not Done - not connected from both sides	Not done
69	2.2.2.2	2" Combination Air Valve Chamber	A.R.V.12	Z6-YAT-70-1	0+157.70	Done	Done	Not done	Not Done	Not done	Done	Done
70	2.2.2.2	2" Air Release Valve	A.R.V.10	Z6-YAT-37	0+074.93	Done	Done	Not done	Not Done	Not done	Done	Done
71	2.2.2.2	2" Air Release Valve	A.R.V.01	Z1-YAT-71	0+373	Done	Done	Done	Not Done	Not done	Done	Done
72	2.2.2.2	2" Air Release Valve	A.R.V.02	Z2-YAT-42	0+012	Done	Done	Not done	Not Done	Not done	Done	Done
73	2.2.2.2	2" Air Release Valve	A.R.V.03	Z2-YAT-41	0+013	Done	Done	Not done	Not Done	Not done	Done	Done
74	2.2.2.2	2" Air Release Valve	A.R.V.04	Z3-YAT-38	0+137	Done	Done	Not done	Not Done	Not done	Done	Done
75	2.2.2.2	2" Air Release Valve	ARV05	Z3-YAT-35	0+007	Done	Done	Done	Not Done	Not done	Done	Done
76	2.2.2.2	2" Air Release Valve	ARV019	Z7-YAT-29	0+000	Done	Done	Done	Not Done	Not done	Done	Done
77	2.2.2.2	2" Air Release Valve	ARV07	Z3-YAT-34	0+010	Done	Done	Done	Not Done	Not done	Done	Done
78	2.2.2.2	2" Air Release Valve	ARV014	Z7-YAT-28	0+801	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-28	Not Done
79	2.2.2.2	2" Air Release Valve	ARV15	Z7-YAT-13	0+551	Done	Done	Done	Not Done	Not done	Done	Done
80	2.2.2.2	2" Air Release Valve	A.R.V. 11	Z6-YAT-53	0+298	Done	Done	Not done	Not Done	Not done	Done	Done

Figure 12. Precast Manholes/Chambers- remining works for each chamber (Part 3)

No.	BOQ Item	Description	Chmber ID	Location	Station	Installation	Cover	Vent	Step Ladder	Reinstatement	Completed external connection	Valves Installation
81	2.2.2.2	2" Air Release Valve	A.R.V.20	Z7-YAT-29	1+081	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-29	Not done
82	2.2.2.2	2" Air Release Valve	A.R.V.017	Z8-YAT-75	0+039	Done	Not done	Not done	Not Done	Not done	Not Done - not connected to new YAT-75	Not done
83	2.2.2.2	2" Air Release Valve	A.R.V.018	Z7-YAT-30	0+490	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-30	Not done
84	2.2.2.2	2" Air Release Valve	A.R.V.016	Z7-YAT-16	0+854	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-16	Not done
85	2.2.2.2	2" Air Release Valve	A.R.V.022	Z8-YAT-51	0+025	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-51	Not done
86	2.2.2.2	2" Air Release Valve	A.R.V.023	Z8-YAT-46	0+010	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-46	Not done
87	2.2.2.2	2" Air Release Valve	A.R.V.08	Z4-YAT-77	0+080	Done	Not done	Not done	Not Done	Not done	Not Done - not connected to new YAT-77	Not done
88	2.2.2.2	2" Air Release Valve	A.R.V.28	Z9-YZT-14	0+010	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-14	Not done
89	2.2.2.2	2" Air Release Valve	A.R.V.25	Z8-YAT-85	0+320	Done	Not done	Not done	Not Done	Not done	Not Done - not connected to new YAT-85	Not done
90	2.2.2.2	2" Air Release Valve	A.R.V.24	Z8-YAT-22	0+090	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-22	Not done
91	2.2.2.2	2" Air Release Valve	A.R.V.30	Z9-YZT-23	0+290	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-23	Not done
92	2.2.2.2	2" Air Release Valve	A.R.V.31	Z9-YZT-23-1	0+530	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-23-1	Not done
93	2.2.2.2	2" Air Release Valve	A.R.V.27	Z9-YZT-21	0+048	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-21	Not done
94	2.2.2.4	3" Air Release Valve	A.R.V.01	TP-YAT-01	0+017	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-01	Not done
95	2.2.3.2	2" Washout Chamber	W.O 06	Z6-YAT-70-1	0+037.44	Done	Done	Done	Not Done	Not done	Done	Done
96	2.2.3.2	2" Washout Chamber	W.O.07	Z6-YAT-53-1	0+354.92	Done	Done	Done	Not Done	Not done	Done	Done
97	2.2.3.2	2" Washout Chamber	W.O.01	Z1-YAT-71-1	0+109	Done	Done	Done	Not Done	Not done	Done	Done
98	2.2.3.2	2" Washout Chamber	W.O.03	Z2-YAT-41-1	0+586	Done	Done	Not done	Not Done	Not done	Done	Done
99	2.2.3.2	2" Washout Chamber	W.O 012	Z7-YAT-30	1+129	Done	Done	Not done	Not Done	Not done	Done	Done
100	2.2.3.2	2" Washout Chamber	W.O 04	Z3-YAT-34	0+287	Done	Done	Done	Not Done	Not done	Done	Done
101	2.2.3.2	2" Washout Chamber	W.O.08	Z7-YAT-13	0+421	Done	Done	Done	Not Done	Not done	Done	Done
102	2.2.3.2	2" Washout Chamber	W.O 09	Z7-YAT-13	0+884	Done	Done	Done	Not Done	Not done	Done	Done
103	2.2.3.2	2" Washout Chamber	W.O.11	Z7-YAT-31	1+318	Done	Done	Not done	Not Done	Not done	Not Done - not connected to new YAT-31	Not done
104	2.2.3.4	3" Washout Chamber	W.O.01	Z3-YAT-35	0+390	Done	Done	Done	Not Done	Not done	Done	Done

Figure 13. Precast Manholes/Chambers- remining works for each chamber (Part 4)

5. CONTROL VALVES AND SCADA

There is currently no SCADA on the YWSP area. The objective is to design a new SCADA system. This new Scada center will be located in YM and it will enable to monitor the main connection points as well as the the three new reservoirs (beit Ammra, Khalet Salem and School Reservoir).

Specifications and details will be provided at detailed design stage.

5.1 FLOWMETERS- CONNECTION CHAMBERS

Electromagnetic flow meters are to be installed along the main transmission pipelines at the main connection systems. This section includes only the flow meter up to the distribution tank. The strategic locations for the flow meter had been identified in order to:

- Increase the monitoring of the flows
- Contribute determining with accuracy the water losses
- Help the operator to balance the flows between served area

A total of 6 electromagnetic flow are to be installed at the main connection points in addition to three more at the three reservoirs. Figure (14) shows the main connections chambers.

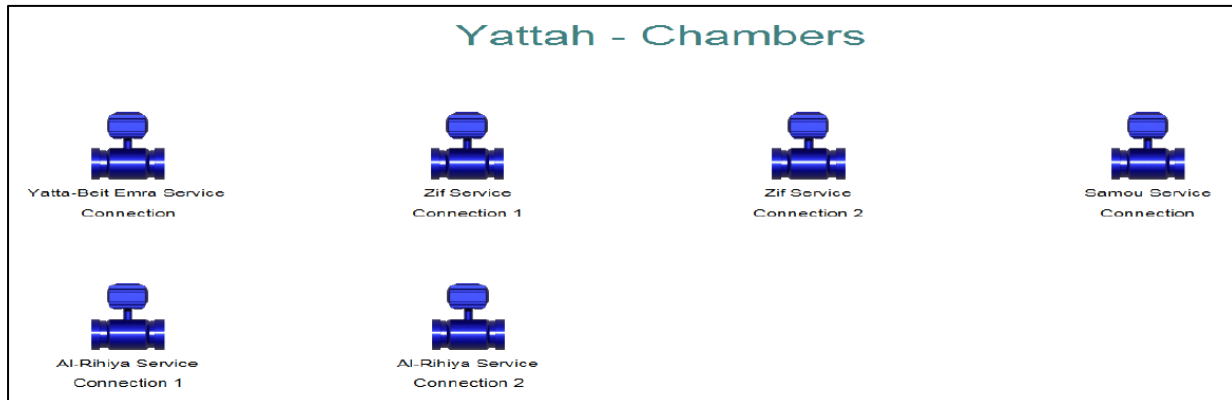


Figure 14. Yata SCADA System- Main Connections

Flow control chambers installed all along pipeline will be equipped with the following valves (minimum):

- 2 electromagnetic flow meter (one is spare) which require the standard 5 diameters of straight pipe run upstream and 3 diameters of straight pipe run downstream.
- 1 strainer.
- 2 Isolation valves.
- 2 dismantling joints.
- 1 connecting joint to insert chamber into the system.
- Wireless system for data transmission.
- Control system and Panel.

Table 17 lists the details of each Flow control chamber.

Table 18. Main Monitoring (Connection) Valve

No.	Connection Valve	Function	Diameter (mm)	Available in PWA storage area
1	ZEIF 1	Service Connection	250	Yes
2	ZEIF 2	Service Connection	250	Yes
3	Al- Rihya Chamber 1	Service Connection	300	Yes
4	Al- Rihya Chamber 2	Service Connection	300	Yes
5	Samou	Service Connection	300	Yes
6	Beit Ammra	Service Connection	150	Yes

5.2 FLOWMETERS- AT RESERVOIR

Electromagnetic flow meters are to be installed at the inlet and outlet of each reservoir. This section includes only the flow meter of the reservoirs.

A total of 6 electromagnetic flow are to be installed in the three reservoirs. Figure (15) shows the main reservoir flow meters.

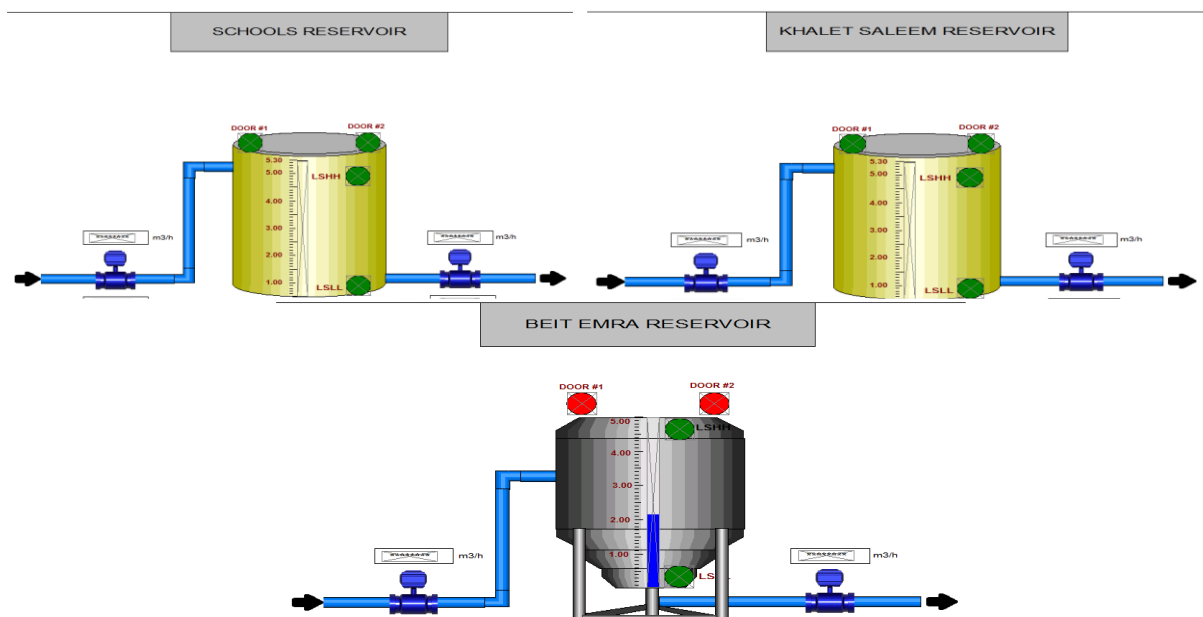
**Figure 15. Yata SCADA System- Main Reservoirs**

Table 18 lists the details of each Flow control.

Table 19. Main Monitoring (Connection) Valve

No.	Flow Meter	Function	Diameter (mm)	Function	Diameter (mm)	Available in PWA storage area
1	Beit Ammra	Inlet	150	Outlet	150	Yes
2	School Reservoir	Inlet	300	Outlet	300	Yes
3	Khalet Salem	Inlet	250	Outlet	300	Yes

5.3 RESERVOIRS LEVEL SENSOR

Each reservoir will be equipped with a level sensor. These level sensors will be connected to the SCADA using RTU system in order to allow YM to monitor the level of the water inside the reservoirs.

5.4 SCADA PHILOSOPHY

The clauses in this section define the general requirements and standards of workmanship for the manufacture, supply, installation and commissioning of all SCADA equipment, and shall be applicable to these works.

5.4.1 Description of works

The purpose of this section is to describe the functionality of both SCADA systems to implement in WBWD system and Yatta system:

- In WBWD, a SCADA system already exists: the purpose of the present project is to update the SCADA with new data, to monitor flows.
- In Yatta system, there is no SCADA system: a new SCADA system shall be created for monitoring and control/command of valve chambers, reservoirs sites, and pumping stations.

The SCADA systems shall be implemented as operational management tool i.e. shall provide with facilities to undertake the day to day monitoring (and control/command for Yatta only) of the facilities and the production of general management information.

5.4.2 Scope of works

The Scope of works comprises:

Supply, installation and commissioning of the Yatta SCADA control center workstation sized to monitor and control around 1000 database points, complete with:

- Operating system
- All necessary data storage devices
- Printing devices
- Furniture
- Communication equipment and cabling for communication with the data loggers and PLCs equipment located throughout the network.
- Supply, installation and commissioning of the Yatta SCADA system software sized to monitor and control around 1000 database points
- Supply, installation and commissioning of the communications network including lightning protections units via a cable communication network for the PLCs.
- Supply of all necessary PLCs equipment.
- Supply, installation into electrical panels, interface to instrumentation signals and commissioning of PLC equipment.
- Supply of all necessary PLCs programming equipment, software and licences.
- Supply of all necessary data loggers equipment, software and licences.
- Configuration of the Yatta SCADA system database including programming of all data loggers and PLCs equipment to perform local control.
- Configuration of the WBWD SCADA system database including programming of all data loggers and PLCs equipment to perform local control.

5.4.3 Description of Yatta SCADA System

The system to be implemented shall be able to operate within the control strategy described in the following paragraphs but shall be flexible enough to be easily changed should the control philosophy change.

5.4.3.1 SCADA System Overview

The purpose of the new SCADA system is the following:

- Monitoring and Control/command on 3 reservoirs sites : Beit Ammra, School Reservoir, Khalet Salem. The objective is to monitor flow and level within this project and control/command motorized valves for future.

5.4.3.2 SCADA System Architecture

The proposed architecture for the new SCADA system is described below.

A. SCADA control-command center

- 1 operator workstation (1 computer, 1 screen, 1 keyboard and 1 mouse) with 3 disks
- 1 firewall and VPN router for GSM/GPRS system
- 1 UPS for the workstation
- 1 PLC for local data acquisition
- 1 A4 colour laser printer

B. Local sites (pumping stations, reservoirs)

For reservoirs sites the equipment will be the following:

- 1 PLC with GSM/GPRS (3G) communication cards
- Deployed I/O modules
- 1 Human Machine Interface (HMI) integrated on the PLC or deployed
- 1 UPS
- 1 antenna GSM/GPRS integrated to the GSM/GPRS communication card or deployed

The Yatta SCADA architecture shall be design by the Contractor

5.4.3.3 Future SCADA architecture

The measured data will be connected directly to the control center, to monitor instantaneous values (flows, pressures, levels, chlorine) and status in the control room.

The GSM/GPRS (3G) connection should be of type VPN for data reliability, especially for control/command function.

The communication will be real-time.

5.4.3.4 SCADA Control System Hardware

A control center should be established in the Yatta municipality in Yatta to accommodate the SCADA system equipment and workstation.

The SCADA Control System equipment shall be as defined in chapter 2 here after.

Equipment for the control center shall be supplied and installed by the contractor and shall include:

- 2 no. flat top desks complete with integral cabling system and electrical sockets
- 1 no. lockable cupboard to be located beneath desk
- 1 no. swivel chair with a duty of 8 hours continuous use

Equipment shall match.

5.4.3.5 SCADA Control System Software

This new Yatta SCADA system shall be fully compatible with existing WBWD SCADA system described here after that is to say: Al Yamoun SCADA system should have a compatible software and same design philosophy as WBWD SCADA system.

For the period preceding the transfer of asset, a read-only access to the Yatta SCADA data should be implemented on the SCADA WBWD workstations or opposite if requested. After the transfer of asset, access and rights to the SCADA data could be modified according to new respective responsibilities of Yatta and WBWD.

5.4.4 Description of WBWD SCADA system

5.4.4.1 Existing SCADA System Overview

A SCADA system was developed at WBWD in 2012-2013. This system was implemented under a project funded by USAID, and represents the first phase of the SCADA project. In this first phase, the SCADA functionalities was limited to monitoring. In the future, control-command is also to be developed.

The SCADA control center is located in WBWD office in Ramallah.

Communication with the control center is made through radio (UHF or microwave) for pumping stations and wells and through GSM/GPRS system for the valve chambers. For the radio system, each tower has a Front End Processor (FEP) and communicates with the control center through a VPN (Virtual Private Network).

5.4.4.2 Existing SCADA System Architecture

The architecture of the existing SCADA system is presented below. The details characteristics of the hardware are given here after.

Architecture of the existing supervision system

LOCATION	SCADA SOFTWARE	RTU	MONITORED SITES	COMMUNICATION TYPE
Ramallah control center	ELUTIONS - Control Maestro 2011	SIEMENS SITRANS FM MAG 8000 FDK	Valve chambers	GSM/GPRS
		MOTOROLA ACE3600	Around 40 Wells 5 pumping stations (Tubas, Tamoun, Aqqaba, Meithalun, Rugib)	UHF/ microwave radio

5.4.4.2.1 Existing hardware equipment

A. Servers

The SCADA system is composed of two cabinets installed in an air-conditioned room.

The first cabinet contains seven servers HP PROLIANT DL380p G8, type SFF with radio transmitter and firewall:

- SCADA Server-1 (Primary)
- SCADA Server-2 (Secondary)
- Historian
- System/Data Backup and Recovery
- Primary Domain Server
- Secondary Domain Server
- SCADA Web Server

The second cabinet, related to data transferred through GSM/GPRS system, contains:

- A firewall Watchguard XTM 5 Series
- A switch HP 2530 48G
- Three servers HP PROLIANT DL360p G8 (two redundants and one historian).

B. Control room

The control room is composed of two SCADA operator workstations, one SCADA Web Client Workstation, completed by three screens and one large screen, and three printers. There is also one laptop connected to the SCADA located in the SCADA engineer office.

C. RTU

The PLCs of each well were re programmed during Phase 1 of the SCADA project and new RTU of type Motorola ACE3600 were integrated with.

WBWD uses electromagnetic flow meters equipped with transmitters from the same manufacturer. Each transmitter has two analogic inputs, for instantaneous flow and pressure if any.

NB: The total volume displayed on the workstations is a calculated value, based on the instantaneous flow.

5.4.4.2.2 Existing SCADA control system software

The software is Control Maestro 2011 developed by Elutions Inc.

This SCADA software has an Object-oriented design. It delivers real-time and historical information and offers a Web-enabled remote access from anywhere via Internet and/or PDAs.

5.4.4.2.3 Present Project content

The scope of work of the SCADA component of the current project for the WBWD system is to connect to the SCADA 9 flow meters located in valves chambers or reservoir, for monitoring only. No motorized valve is required anywhere: as a result no remotely controlled valves are required.

The objective of the present design is to integrate seamlessly with the existing SCADA system the data newly obtained from the new or replaced flow meters. In some cases a pressure indicator should also be monitored (see detailed table here after).

WBWD requirements are the following:

- Automatic communication between flow meter and control center once per 24 hours
- Battery power with 5-year autonomy.

A. Architecture

The measured data will be connected directly to the control center in Ramallah, to monitor instantaneous flows, pressures and totalized flows in the control room.

To transmit data from flow meters and pressure indicators to the SCADA control center, data loggers or PLCs (depending on site characteristics, see detailed table in paragraph 5.4.5.6) should be supplied, installed and commissioned under this contract.

B. Communication

It is required to use GSM/GPRS (3G) communication system between the flow meter chambers and the control center. The connection should be of type VPN.

The capacity of the HP PROLIANT DL360p G8 servers is sufficient to integrate the new monitored data.

C. From Historical system to real-time system

The time stamping at source of data could be integrated in the existing software for some specific communication protocols (for example: Softbus). The new equipment should use one of those protocols; otherwise it will be necessary to use an OPC server.

D. Data loggers and PLCs

The data loggers shall have as a minimum the following features:

- 4 Digital Inputs for counting, and alarms (battery, flooding and intrusion), with dry-contact acquisition.
- One or two Analogic Inputs (as per above detailed table) enabling acquisition of 4-20 mA signals, which could be powered directly by the data logger.
- Integrated GSM/GPRS (3G) Communication Cards
- 7-year autonomy lithium battery.

5.4.5 Works included for the two SCADA control centers

5.4.5.1 MIMIC DISPLAY

They will include all mimics listed below.

All mimics shall be suitable for display all sizes of monitor supplied within the contract and careful design of the mimic shall be used to this end. Where mimics replicate those configured for the local PLC display, the mimics shall be identical to those displayed on the PLC display.

The following requirements are required for all mimics:

- The background colour for all mimics shall be subject to the approval of the Engineer.
- Each mimic shall have navigation "pushbutton" to the process overview, the geographical overview and associated process mimics.
- The symbols used to describe the water supply network items shall be subject to the approval of the Engineer.
- Mimics shall display process lines as colour dynamic with arrow indication of flow direction.
- Alarms indication shall be animated within the relevant mimic.
- Trend pages (including historic and current information) and the alarm summary page shall be available from every mimic.

- Each on-site workstation shall be configured such that a screen dump can be printed by a single keyboard/on-screen action.
- Control pages for all equipment that can be controlled, overridden or equipment data entered manually shall be available for every mimic.

A. Yatta Mimics

The contractor shall create the following mimics:

- 1 mimic per reservoir sites: : Beit Amra, School Reservoir, Khalet Salem.

TOTAL: 3 mimics

B. WBWD Mimics

The contractor should create 1 new mimics per chamber/ reservoir to integrate the new flow meter readings, that is to say 9 new mimics in total.

5.4.5.2 ALARM FACILITIES

The alarm list shall be configured in accordance with the following Chapter 2. The colours used to describe the state and priority of each alarm shall be subject to the approval of the Engineer.

The facility shall be fitted to enunciate user definable alarms that have been accepted within a user definable period via the klaxon and lights associated with each control panel. The klaxon and light at each panel shall be reset on acceptance of the alarm.

5.4.5.3 HISTORIC INFORMATION

The SCADA system will save automatically the current day's historic data and delete any data greater than 365 days old at midnight. The facilities shall be provided to recover data greater than 365 days old from the archive device.

5.4.5.4 REPORT GENERATION

A. Yatta reports

The contractor should configure 10 no. simple reports proving statistical information relating to the performance of the water supply utility. The content of the reports shall be subject to the approval of the Engineer.

B. WBWD reports

The contractor should configure at least 10 no. simple reports proving statistical information relating to the performance of the water supply utility. The content of the reports shall be subject to the approval of the Engineer.

5.4.5.5 SCADA SYSTEM DATA BASE CONFIGURATION

The Contractor shall configure the SCADA database to include all input/output requirements. This shall include, but not be limited to:

- Descriptions.
- High, High-High, Low-Low and Low alarm levels.
- Alarm text.
- Alarm priorities.
- Dead-bands.
- Persistency (How long the signal must be in alarm condition before alarm is raised).
- Historic data for trending of inputs etc.
- Scanning intervals.

The following shall be saved to disc, for display on the SCADA system:

- Pressure readings,
- Flow meter readings in valve chambers and on reservoir and pumping station sites,
- Total flows (per hour, day, month and year),
- And for Yatta only:
- Level readings,
- Chlorine readings,
- Hours run for pumps.

5.4.5.6 INPUTS/OUTPUTS REQUIREMENTS

5.4.5.6.1 PLC – for each reservoir

LOCATION	EQUIPMENT	NUMBER	DI	AI	DO	AO
Beit Ammra	Flowmeter (Nb)	2	2	2		
	Level meter (Nb)	1		1		
	TOTAL		2	3		
LOCATION	EQUIPMENT	NUMBER	DI	AI	DO	AO
School Reservoir	Flowmeter (Nb)	2	2	2		
	Level meter (Nb)	1		1		
	TOTAL		2	3		
LOCATION	EQUIPMENT	NUMBER	DI	AI	DO	AO
Khalet Salem	Flowmeter (Nb)	2	2	2		
	Level meter (Nb)	1		1		
	TOTAL		2	3		

5.4.5.6.2 Data logger Valve chambers of WBWD utility

NO.	CHAMBER NAME	DESCRIPTION	NEW CHAMBER	ANALOG INPUT	NOTE
1	Ziif 1	Underground Chamber	Yes	1	-
2	Ziif 2	Underground Chamber	No	1	-
3	Al Reyhia 1	Underground Chamber	Yes	1	-
4	Al Reyhia 2	Underground Chamber	Yes	1	-
5	Beit Ammra Connection	Underground Chamber	Yes	1	-
6	Samoo'	Underground Chamber	Yes	1	-
7	Beit Ammra Inlet	Above ground	Yes	2	-
8	Shcool Inlet	Underground Chamber	Yes	2	-
9	Khalet Salem Inlet	Underground Chamber	Yes	2	-

5.4.6 Standards

The works for control and supervisory systems shall be designed, manufactured and tested according to the relevant codes, standards, rules, and regulations as listed below, all in latest valid edition.

In case of any inconsistency or conflict exists between the different specifications, codes, forms or drawings and standards, the more restrictive shall be applied.

- IEC 21989 : Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Specification, functional model and information flows - Short message service.
- IEC 21990 : Information technology - Telecommunications and information exchange between systems - Private Integrated Services Network - Inter-exchange signalling protocol - Short message service.
- IEC 60068 : Environmental testing – All Parts.
- IEC 60870 : Telecontrol equipment and systems – All Parts.
- IEC 61000 : Electromagnetic compatibility (EMC) – All Parts.
- IEC 61010 : Safety requirements for electrical equipment for measurement, control, and laboratory use – All Parts.
- IEC 61131 : Programmable controllers – All Parts.
- IEC 61326 : Electrical equipment for measurement, control and laboratory use – EMC requirements – All Parts.
- IEC 61784 : Industrial communication networks - Profiles – All Parts.
- IEC 61850 : Communication networks and systems for power utility automation – All Parts.
- IEC 62008 : Performance characteristics and calibration methods for digital data acquisition systems and relevant software.
- BS 5887 : Code of practice for testing of computer based systems.
- BS 6238 : Code of practice for performance monitoring of computer based systems.
- BS 6739 : Code of practice for instrumentation in process control systems - installation design and practice.

5.5 SCADA MONITORING ROOM

The SCADA monitoring room will be located in YM premises. In the detailed design phase, YM shall provide a separate room with minimum 3mX3m dimension room for the SCADA devices.

6. CAPACITY BUILDING COMPONENTS

This section summarizes the expected scope of works for the capacity building components as a result of the Assessment study/report, initial ESIA study and Institutional and capacity building study. This covers the followings:

6.1 TRANSFER OF ASSETS

In 2019, the project management of the project considers PWA as the Employer and Yata municipality as the final beneficiary. This shall remain the same in the YWSP new project. However, the project components of the project shall be transferred to be part of YM assets. The Water Law 2014, and the regulation of MoLG shall be the bases for such transfer.

The main objectives and the expected output for the transfer of assets are:

- A. Full knowledge of the fixed assets, fixed assets manual and proposed price lists;
- B. Fixed assets registration and valuation;
- C. Support the YM in registering its fixed assets and attaching all needed supporting documents;
- D. Verify the information of the fixed assets at the time of data collection to ensure that the fixed assets are registered and recorded as stated in the valuation;
- E. Physical inspection of the fixed assets;
- F. Review the standard price list, in terms of adequacy and reliability. The list is to be updated. It will be used for establishing the replacement cost in terms of adding new items; modify the depreciation life period and the adequacy of the proposed rate according to market price at the time of valuation;
- G. The process of land valuation is to be documented and delivered;
- H. Training of YM staff on updating the fixed assets registers.

This task shall be done by an individual consultant.

6.2 INSTITUTIONAL AND CAPACITY BUILDING

Based on the recommendations of the Institutional and Capacity building report, a RFP and TOR shall be prepared. It shall cover the followings topics:

- ❖ Public awareness.
- ❖ Development of YWSD including all needed MOU's, documentation, approvals etc.

The institutional setup for the water supply service shall be changed.

6.3 PROCUREMENT OF EQUIPMENT

To enhance the O&M of the water network and support the technical challenges and the DP objectives, proper equipment should be provided to YMWD. **Table 20.** list some equipment and supplies that are recommended to be provided to YMWD and YM.

Table 20. Recommended Equipment

No.	Items	Quantity
1.	5-ton truck	2
2.	Backhoe loader	2
3.	4X4 pick up	1
4.	Wheeled Excavator	1
5.	Skid-Steer Loader with weepster "Collector Sweeper"	1
6.	Mobile welding generator	2
7.	Small mobile generator 9 kw	2
8.	Power Threading Machines	2
9.	Hand Held power Drives	1
10.	Plate Compactor	2
11.	Chlorine dosing pump	1
12.	Asphalt cutting machine	2
13.	Diamond core drill wet and dry	1
14.	Mobile air compressor with Jack Hammer	1
15.	Wrenches combination spanner set	6
16.	Correlate & Electroacoustic water leak detection device	1
17.	Manhole cover detector	2
18.	GPS for surveying with accessories	1
19.	Server station	1
20.	Plotter	1
21.	Office printer	3
22.	GIS/CAD workstation	3
23.	Pipe Testing Compressor	1
24.	18 Ton Truck with 10m3 Water Tank	1

6.4 TRAINING OF YM STAFF

Derived from the main findings and recommendations in the Institutional report, the following Table 20 provides a concise overview on preliminary activities for increased efficiency of the YWSD.

Table 21. Recommended Training Topics

No.	Training Topics	No. of Persons	Training entity	Duration (Weeks)
1	Leak detection- theoretical applications	3	International	2
2	Leak detection- practical applications	2	Local	2
3	Water Network Management (Distribution)	3	International	2
4	Operation and Maintenance	3	Local	2
5	Water Quality	2	Local	2
6	SCADA	3	International	3

7. PRELIMINARY COST ESTIMATE AND WORKS PACKAGES

7.1 PRELIMINARY COST ESTIMATE

The purpose of estimating is to determine the forecast costs required to complete a project in accordance with the contract plans and specifications. The cost estimate were done within reasonable accuracy, the total costs for a given project.

Two distinct tasks in estimating were taking into consideration:

- A. to determine the probable real cost and
- B. to determine the probable real time to build the project.

This aspect mentioned above is of significant importance and allows an integration of the estimating and scheduling functions of construction management.

7.1.1 Construction Costs

Table 21 summarizes the Construction Costs for YWSP. More details are presented in Appendix 2.

Table 22. Construction Works Components and Prices

No.	Items	Firm Total (US Dollar)	Conditional Total (US Dollar)
1	Preliminary Works: Mobilization and Demobilization	255,990	-
2	Provisional Items/ Day Works	328,038	-
3	YATTA TRANSMISSION MAINS & DISTRIBUTION NETWORKS- Supplementary Works	923,788	-
4	Pavement repair and reinstatement	750,000	2,100,000
5	Complementary Works: Beit Ammra 500m3 Elevated Tank	147,190	-
6	Complementary Works: School Tank 1000m3 Reservoir	106,450	-
7	Complementary Works: Khalet Salem 5000m3 Reservoir	207,570	-
8	SCADA Work for WBWD	70,000	-
9	SCADA Work for Yata Municipality	127,391	-
10	DISTRIBUTION NETWORKS- Extension area	1,190,513	-
11	Spare Parts	0	231,075
12	Provisional Sum Item	4,200	-
Total (US Dollar)		4,111,129	2,331,075

7.1.2 Supervision Costs

Based on the consultant assessment, our recommendation is that the project shall be supervised by a consultant firm. The consultant can be local firm.

Table (22), present the minimum staff required for the supervision. Base on the aforementioned table and the presented staff and allocated man moths, the cost estimate for the supervision contract is 125,400 US Dollar.

Table 23. Supervision Costs and min. staff Requirements

No.	Position	Part/ Full time	No. of Months
1	Project Manager (RE)	Full Time	12
2	Site Engineer	Full Time	8
3	Mechanical Engineer	Part Time	3
4	Electrical/ SCADA engineer	Part Time	3
5	Office Support	Full Time	12

7.1.3 Training Programme Costs

Derived from the main findings and recommendations in the Institutional report, the following Table 23 provides a concise overview on preliminary activities for increased efficiency of the YWSD.

Table 24. Recommended Training Topics

No.	Training Topics	No. of Persons	Training entity	Duration (Weeks)	Total Cost (US Dollar)
1	Leak detection- theoretical applications	3	International	2	36,480
2	Leak detection- practical applications	2	Local	2	5,130
3	Water Network Management (Distribution)	3	International	2	36,480
4	Operation and Maintenance	3	Local	2	6,270
5	Water Quality	2	Local	2	5,130
6	SCADA	3	International	3	47,880
Total (US Dollar)					137,370

7.1.4 Transfer of Assets Costs

Derived from the main findings and recommendations in the Institutional report, it was found that a transfer of assets is a necessary. The expected Cost for the transfer of assets is 17,100 US Dollar.

7.1.5 Capacity Building and institutional setup Costs

The expected Cost for the Capacity building and institutional is 39,900 US Dollar. This can be divided for the public awareness as well as the development of YWSD including all needed MOU's, documentation, approvals etc.

7.1.6 Supply of Equipment Cost

The proposed equipment prices were collected from different suppliers. Table 24 present the list of equipment and its estimated costs.

Table 25. Procurement of Equipment Costs

No.	Items	Quantity	Unit Price (US Dollar)	Total Cost (US Dollar)
1.	5-ton truck	2	79,800	159,600
2.	Backhoe loader	2	114,000	228,000
3.	4X4 pick up	1	45,600	45,600
4.	Wheeled Excavator	1	296,400	296,400
5.	Skid-Steer Loader with weepster "Collector Sweeper"	1	68,400	68,400
6.	Mobile welding generator	2	28,500	57,000
7.	Small mobile generator 9 kw	2	1,140	2,280
8.	Power Threading Machines	2	2,850	5,700
9.	Hand Held power Drives	1	1,710	1,710
10.	Plate Compactor	2	2,850	5,700
11.	Chlorine dosing pump	1	570	570
12.	Asphalt cutting machine	2	1,710	3,420
13.	Diamond core drill wet and dry	1	3,192	3,192
14.	Mobile air compressor with Jack Hammer	1	22,800	22,800
15.	Wrenches combination spanner set	6	513	3,078
16.	Correlate & Electroacoustic water leak detection device	1	5,700	5,700
17.	Manhole cover detector	2	2,850	5,700
18.	GPS for surveying with accessories	1	20,520	20,520
19.	Server station	1	1,710	1,710
20.	Plotter	1	4,560	4,560
21.	Office printer	3	342	1,026
22.	GIS/CAD workstation	3	1,710	5,130
23.	Pipe Testing Compressor	1	6,270	6,270
24.	18 Ton Truck with 10m3 Water Tank	1	79,800	79,800
Total (US Dollar)				1,033,866

7.1.7 Summary of Total Costs

Table 26. Total Estimated Cost for YWSP (All Components)

	Description	Cost Estimate (US Dollar)
1	Construction Works	6,442,204
2	Supervision for Construction Works	125,400
3	Capacity building and institutional	39,900
4	Procurement of Equipment	982,313
5	Trainings programme	137,370
6	Transfer of Assets	17,100
Total (US Dollar)		7,744,287

Table 27. Total Estimated Cost for YWSP (Priorities)

	Description	Cost Estimate Priority 1 (US Dollar)	Cost Estimate Priority 2 (US Dollar)
1	Construction Works	4,111,129	2,331,075
2	Supervision for Construction Works	125,400	-
3	Capacity building and institutional	39,900	-
4	Procurement of Equipment	280,000	702,313
5	Trainings programme	137,370	-
6	Transfer of Assets	17,100	-
Total (US Dollar)		4,710,899	3,033,388

7.2 TENDERING DOCUMENTS

The type of Tendering procedure for Construction Works and Capacity Building can be further discussed at the second phase of the consultancy assignment. In Table 26 and 27 the consultant proposes the tender packages.

Table 28. Tender Documents Types

No.	Tender Name	Entities	Consultant Suggestions
1	Construction Works	Contractors	<u>WB Templet</u> : Selection of Contractor <u>National bid</u> : National Competitive Bid (NCB) <u>Prequalification</u> : No <u>Type of Contract</u> : Fixed Price <u>Type of Selection</u> : Cost Based (lowest responsive bidder)
2	Supervision for Construction Works	Engineering Firms (Consultants)	<u>WB Templet</u> : Selection of Consultants <u>National bid</u> : National Competitive Bid (NCB) <u>Prequalification</u> : Yes <u>Type of Contract</u> : Time Base <u>Type of Selection</u> : Quality and Cost Based (QCBS)
3	Capacity building and institutional	Engineering Firms (Consultants) and NGO's	<u>WB Templet</u> : Selection of Consultants <u>National bid</u> : National Competitive Bid (NCB) <u>Prequalification</u> : Yes <u>Type of Contract</u> : Lump Sum <u>Type of Selection</u> : Quality and Cost Based (QCBS)
4	Procurement of Equipment	Suppliers	<u>WB Templet</u> : Procurement of Goods <u>National bid</u> : National Competitive Bid (NCB) <u>Prequalification</u> : No <u>Type of Contract</u> : Fixed Price <u>Type of Selection</u> : Cost Based (lowest responsive bidder)
5	Trainings programme	Engineering Firms (Consultants)	<u>WB Templet</u> : Selection of Consultants <u>National bid</u> : National Competitive Bid (NCB) <u>Prequalification</u> : Yes <u>Type of Contract</u> : Lump Sum <u>Type of Selection</u> : Quality and Cost Based (QCBS)
6	Transfer of Assets	Engineering Firms (Consultants) and NGO's	<u>WB Templet</u> : Selection of Consultants <u>National bid</u> : National Competitive Bid (NCB) <u>Prequalification</u> : Yes <u>Type of Contract</u> : Lump Sum <u>Type of Selection</u> : Quality and Cost Based (QCBS)

Table 29. Proposed Procurement Plan

<u>Contract name</u>	<u>Cost Estimate (US Dollar)</u>	<u>Type of contract</u> ¹	<u>Type of competition</u> ²	<u>Procurement procedure</u> ³	<u>Selection method</u> ⁴	<u>Planned Start date</u>	<u>Planned Contract completion date</u>
Construction Works	6,442,204	W	NPC	OIB	LESCB	May 2022	May 2023
Supervision for Construction Works	125,400	C	NPC	REOI	QCBS	May 2022	May 2023
Capacity Building and institutional	39,900	C	NPC	REOI	QCBS	July 2022	Jan 2023
Procurement of Equipment	1,033,866	G	NPC	OIB	LESCB	July 2022	June 2023
Trainings programme	137,370	C	NPC	REOI	QCBS	July 2022	June 2023
Transfer of Assets	17,100	C	NPC	REOI	QCBS	Aug 2023	Nov 2023

¹ C for consulting services; IC for individual consultants; W for works; G for goods; P for Plants; NC for non-consulting services.

² NPC: national procurement competition; IPC: international procurement competition.

³ For goods, works, plants and non-consulting services: PQL+IB: Prequalification and Invitation for Bids; OIB: Invitation for Bids; RQ: Request for Quotations; DC: Direct Contracting.

For consulting services: REOI: Request for Expression of Interest; RQ: Request for Quotations; DC: Direct Contracting.

⁴ For consulting services: QCBS: Quality and Cost Based Selection; QBS: Quality Based Selection; FBS: Fixed Budget Based Selection; LCS: Least Cost Based Selection.

8. PROJECT IMPLEMENTATION/ ACTION PLAN

An implementation schedule has been prepared based upon the results of all assessment reports as well as the defined scope of works. However, the Project's Decision may not be issued until November or December 2021.

Therefore, the bar charts schedule and the action plan may need to be updated in the near future.

The project implementation plan and schedule is presented in the following diagrams based on these main timing assumptions:

- Signature of Phase of the consultancy assignment shall be done in October 2021
- Contract award for supervision in May 2022
- Award of works contract in May 2022
- Works Project duration is 12 Months
- Start of operation defect liability period in May 2023



Figure 16. PROJECT IMPLEMENTATION PLAN FOR WORKS

A detailed YWSP implantation and Action Plan for all project components are presented in Table 28. It summarizes the main millstones related to the implementation of the project including the responsible parties.

Table 30. YWSP Implementation Plan

						2021			2022												2023								2024		
Step	Action	Expected Date of Commencement	Expected Date of Delivery	No. of Months	Party In Charge	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul-Sep	Oct- Dec	Jan- Mar	April	
1	Complete the Detailed Design (Phase 2)	17th of Sep 2021	17th of Dec 2021	3	UG																										
2	Tender of Detailed Design Approval	1st of Jan 2022	15th of Feb 2022	1.5	UNICEF/ PWA																										
3	preparation of Supervision RFP	15th of Feb 2022	15th of Mar 2022	1	UNICEF/ PWA																										
4	Tendering for Works for Contractor	15th of Feb	1st of May 2022	2.5	UNICEF/ PWA																										
5	Tendering for Supervision Firm	15th of Mar 2022	1st of May 2022	1.5	UNICEF/ PWA																										
6	Supervision- Awarding and Contract signature	1st of May 2022	7th of May 2022	0.25	UNICEF/ PWA																										
7	Works- Awarding and Contract signature	1st of May 2022	1st of May 2022	-	UNICEF/ PWA																										
8	Project Implementation	1st of May 2022	31st April 2023	12	Contractor																							Defect Liability period			
9	Supervision	1st of May 2022	31st July 2023	12	Consultant																										
10	Preparation of Procurement of Equipment RFP	1st of April 2022	1st of May 2022	1	UNICEF/ PWA																										
11	Preparation of Training RFP	1st of April 2022	1st of May 2022	1	UNICEF/ PWA																										
12	Tendering for Procurement of Equipment (PoE)	1st of May 2022	1st of July 2022	2	UNICEF/ PWA																										
13	Tendering for Training	1st of May 2022	1st of July 2022	2	UNICEF/ PWA																										
12	PoE- Awarding and Contract signature	1st of July 2022	7th of July 2022	-	UNICEF/ PWA																										
13	Training- Awarding and Contract signature	1st of July 2022	7th of July 2022	-	UNICEF/ PWA																										
14	Implementation of PoE Contract	7th of July 2022	7th of July 2023	12	UNICEF/ PWA																										
15	Implementation of Training Contract	7th of July 2022	7th of July 2023	12	UNICEF/ PWA																										
16	Preparation of Transfer of Assets (ToA) RFP	1st of April 2022	1st of May 2022	1	UNICEF/ PWA																										
17	Preparation of Capacity Building/ Institutional (CBI) RFP	1st of April 2022	1st of May 2022	1	UNICEF/ PWA																										
18	Tendering for ToA	1st of May 2022	1st of July 2022	2	UNICEF/ PWA																										
19	Tendering for Capacity Building/ Institutional	1st of May 2022	1st of July 2022	2	UNICEF/ PWA																										
20	CBI - Awarding and Contract signature	1st of July 2022	7th of July 2022	-	UNICEF/ PWA																										
21	ToA - Awarding and Contract signature	1st of July 2022	7th of July 2022	-	UNICEF/ PWA																										
22	Implementation of ToA Contract	7th of Aug 2023	7th of Oct 2023	3	UNICEF/ PWA																										
23	Implementation of CBI Contract	7th of July 2022	7th of July 2023	5	UNICEF/ PWA																										

9. DISBURSEMENT PLAN/ FORECAST

The disbursement plan/forecasting is the process of creating a model of when future cash expenditures are expected to occur. This information is needed to make fundraising and investment decisions.

The disbursement forecast covers the project different components and proposed contracts according the cost estimates presented in section 3.1. these proposed Contracts are:

- ❖ Construction Works
- ❖ Supervision on Construction Works
- ❖ Capacity building and institutional
- ❖ Procurement of Equipment
- ❖ Trainings programme
- ❖ Transfer of Assets

The cash flow forecast in YWSP can be divided into two parts:

- ❖ Near-term disbursement flows which will occur in 2022.
- ❖ Midterm cash disbursement which will occur in 2023.

Table 29 shows the disbursement cash flow forecast for YWSP. As a conclusion, the expected disbursement for YWSP in 2022 will be around 4,643,064.9 Euro and 2,183,640.1 Euro in 2023.

The fundraising and investment decisions shall consider the above conclusion.



APPENDICES



APPENDIX 1: LISTS OF MATERIALS AVAILABLE FOR THE PROJECT



APPENDIX 2: TENDER DOCUMENTS

INSTITUTIONAL CONSULTANCY FOR CONDUCTING AN ASSESSMENT
FOR THE COMPLETED AND NON-COMPLETED WORKS UNDER FOR
YATTA WATER NETWORK PROJECT AS WELL AS A CAPACITY
ASSESSMENT OF YATTA WATER DEPARTMENT



Kingdom of the Netherlands



The Project is funded by the Kingdom of Netherlands
through UNICEF

Thank You